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**Canadian Wildlife
Service**

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Red Fox



The red fox (*Vulpes vulpes*) is one of Canada's most widespread species. It is found in all provinces and territories, but is absent from most of the Arctic Archipelago, the coast of British Columbia, and Vancouver Island. This wide distribution of the red fox reflects its adaptability to different environments as well as its ability to survive on a varied animal and vegetable diet.

Appearance and colouration

The red fox is a small carnivore with an agile and lightly built frame, and belongs to the same family (Canidae) as the dog, coyote, and wolf. It is distinctive for its coat of long lustrous fur, and its relatively large and bushy brush (or tail) and ruff (or collar). A typical male fox weighs about 12 pounds and stands about 14 inches at the shoulder, while the vixen is usually slightly smaller.

Unfortunately, the name "red fox" does not describe the colour of all members of this species. The red fox is "polytypic", that is, it has several possible colour schemes, some of which may occur within a single litter. The human animal is similar, in that our natural hair colour can vary from blond to black within any interbreeding population.

Common colours for the red fox are "red", "cross", "black", and "silver". The basic colour is "red", in which the individual is red or reddish all over except for a faint brown "cross" on the saddle, black paws, black behind the ears, a black muzzle, white or lighter underside and throat, a white tip to the tail, and perhaps white stockings.

The body colour of the "cross" fox is browner or darker than that of the "red", and it has a dark brown or black "cross". The "black" fox is black all over. The "silver" phase has a black coat with white-tipped fur and, although it occurs in the wild, was selectively bred by fur farmers during the heyday of fox-fur as an item of woman's apparel.



Diet

The red fox is classified as a carnivore because it prefers to eat animal matter, chiefly mice and other small mammals, frogs and insects when in season, and perhaps occasionally a young bird that has fallen from the nest, or the egg of a ground-nesting bird. Investigations of the stomach contents of many hundreds of red foxes in both Canada and the United States have shown that small rodents, such as deer mice and meadow and red-backed voles, make up over 90 per cent of the animal's diet. In times of scarcity the red fox may feed on carrion and, if no flesh is available, on fresh and frozen fruit, such as wild apples, hawthorn or wild rose haws, wild grapes, blueberries. There are reports of foxes making caches of food by burying the uneaten portion of a carcass, but such activity appears to be rare.

Habitat

The red fox in Canada has successfully adapted to the European agricultural systems introduced by settlers over the last three hundred years. It is possibly one of the largest indigenous animals to have become so adept at living in our farming areas, another being an even more omnivorous carnivore, the raccoon (*Procyon lotor*).

It is thought that there are more red foxes alive today in North America than ever before. This came about because the spread of the European settlers and their farms introduced an environment with both trees for cover and open fields for hunting areas. Since the red fox does not compete directly with our agricultural activities for its living, and, in fact, helps most farmers by keeping down the smaller rodents, it should be a welcome animal. However, the red fox has been given the bad name of a poultry thief, and it must be admitted that an occasional individual will take to chicken-stealing, especially if food is scarce, the chickens are not properly penned, and the fox is old or somehow incapacitated for making a living in the wild. Most red foxes, though, interfere neither with our poultry nor our game birds to any appreciable extent.

Distribution

The original habitat of the red fox appears to have been the northern mixed hardwood and softwood forest zones. Undoubtedly, some red foxes occurred both south of this zone in the true hardwood forest, and north in the southern fringes of the tundra, but both these regions were already occupied by foxes – the grey fox (*Urocyon cinereoargenteus*) in the south and the arctic fox (*Alopex lagopus*) in the north. With the cutting of much of the hardwood forest and its replacement by farmlands interspersed with wood lots, fences, cut-over scrub, etc., the tree-loving grey fox has been replaced by the red fox, and in this century the red fox has penetrated as far south as Texas and Florida. At the same time, the red fox has invaded the tundras and is now to be

found over most of mainland Canada and has even been reported from Southampton Island and Baffin Island.

Origin

Because the first permanent European settlers on the North American continent landed in what is now Virginia, where the common fox was the grey fox, it was for a time doubted that the red fox was native to North America. This confusion was further compounded by Colonial gentlemen of the seventeenth and eighteenth centuries introducing European red foxes from France and England to the central Atlantic coastal colonies for the purpose of fox-hunting on horseback and with hounds. These introductions were undertaken because the grey fox climbs trees and will run along the tops of walls and fences when chased, while the red fox stays on the ground and thus can be followed by the hounds. However, the red fox is naturally indigenous to North America and remains have been found by many archaeologists from Indian middens (or refuse heaps) dating back to 2,000 B.C. and by palaeontologists from still further in the past.

Relationship to the European red fox

At one time, taxonomists thought that the North American red fox was a different species from the European red fox, mainly because the smaller European southerly form was compared with the larger North American northerly form. The size differences, added to the separation of the populations by the Atlantic Ocean, were considered conclusive evidence that they comprised separate species. At the time this was accepted, knowledge of Asiatic Russia and especially of Siberia was incomplete, but now it has been demonstrated that the red fox is a holarctic animal, that is, it is distributed on all the circumpolar northern lands with suitable environment, and there are no real gaps or breaks in this continuous population that might suggest there is more than one species of red fox.

Behaviour

The fox has been called sly, cunning, and crafty, all epithets that suggest a deceitful nature. In fact the fox is intelligent, and loyal to its mate and cubs. The fox's intelligence has often exasperated men, and this is possibly the reason for its bad reputation. The dog fox and vixen are thought to pair for life and occupy the same home range with a diameter of perhaps one mile, although the size of the range depends upon the available food supply. The pair may separate for periods during the winter, especially if the hunting is poor, but will come together for breeding and denning.

Denning and breeding habits

After pairing for breeding in January or February, the red foxes seek a suitable den. This is

frequently the discarded burrow of a ground hog, skunk, or ground squirrel, or a convenient shallow cave, hollow tree, or patch of dense bush. The vixen enlarges or alters it to suit her needs and those of the expected litter. The den has one or more entrances, usually about ten inches in diameter. It is often situated on a south-facing slope with a clear space in front of it, where the cubs can play while the vixen watches over them. In dens in earth, the parents usually line the chamber with dry material, such as grass or other leaves, to insulate the newly born cubs from dampness and cold.

The young cubs are born in early April or late March and number about seven to a litter. The cubs live in the den until they are about three months old, when the den is abandoned by the adults, and the young foxes become less dependent on their parents, usually in June or July.

The den is therefore mainly an early summer refuge for the parent foxes and for the cubs until they can begin to take care of themselves. During late summer, the parents finish the training of the cubs and by autumn the cubs leave the parents forever and go their individual ways. From autumn until March of the next year, the foxes bed down in thickets and heavy bush, even during the coldest winter weather. The young foxes that survive the first winter will produce a litter the following March.

The cubs

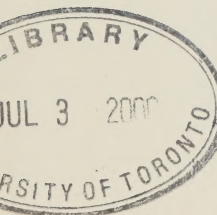
The vixen takes great care of the very young cubs before their eyes are open and at this stage usually keeps the dog fox from entering the den, although he will hunt for them. After the cubs' eyes are open and they begin to crawl, the dog fox will relieve the vixen while she goes hunting. As the cubs are being weaned, both parents will hunt for themselves and will bring back small game for the cubs to play with. This play results in the cubs learning the smell of the game and eventually how to eat it. The last stage for the cubs is that of being trained to hunt. They may have to remain quiet and watch while the parent stalks a mouse in the long grass and later practice this under the parents' eye.

Hunting

A fox hunts by smell, sight, and sound as do most dogs. Its sight is good, and the slight movement of an ear may be all that the fox needs to locate a hidden rabbit. Their sense of smell is excellent, and they can smell hidden nests of young rabbits or eggs covered by long grass. A fox will wait patiently for the sound of a mouse moving along its covered path beneath the ground or in grass or snow and then pounce, or dig quickly to the source of the sound and locate the prey by its scent.

Enemies

The fox's chief enemy is probably man. Other enemies are the larger dog-like carnivores (wolves,



coyotes, dogs), which will usually chase and kill it whenever the opportunity presents itself; the larger cats (lynx, bobcat, and perhaps the puma), which are the mortal enemies of any dog-like carnivore smaller than themselves; and occasionally the bear or wolverine, which may kill a fox if it cannot escape. Some accounts of foxes being attacked by large birds of prey, such as eagles or owls, are recorded, but they appear to be unusual. The fox usually eludes its larger enemies by running away. If flight alone does not provide the escape, then the fox goes to ground in its den or in a thicket or hollow log. Only in the last extremity will the fox turn to fight when the enemy is more powerful or more numerous.

Management

Many provinces have offered rewards for killing various animals that in some way are considered harmful to man, and the red fox has been included among them. The effectiveness of control by this method is doubtful. Since a breeding pair may produce seven cubs a year, and breed for six years, it can be calculated that each pair may produce 42 live cubs. Only two of these need to survive to replace the parents and ensure a stable population. The remaining 40 will die without finding a territory in which to obtain shelter and food. It seems that much of the effort at control is spent to remove young animals that would die of natural causes anyway.

Rabies

The red fox, like all warm-blooded animals, including man, is susceptible to rabies. The fox is an important carrier of rabies in several parts of Canada, and transmits the disease to other wildlife, livestock, household pets and people, through its bite. Other sources of rabies are skunks, raccoons, cats, dogs and bats.

While naturally the red fox will shy away from man, the rabid fox shows no fear and often is seen in daylight. Children should be warned against handling bold or "friendly" foxes. Foaming at the lips, possibly with blood in the foam, shows a late stage of the disease. If a person is bitten, he should cleanse the wound at once and immediately go to a doctor. The nearest federal veterinary authorities (Health of Animals Branch, Canada Department of Agriculture) should be informed at once. If possible, the fox should be caught for examination at one of the Department's Animal Pathology laboratories. Delay could result in death of a human.

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How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province controls the natural resources within its boundaries, including wildlife. However because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Migratory Bird Convention Act and Regulations for the federal government. In practice, federal and provincial governments co-operate in all matters concerning migratory birds. CWS studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's national parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The CWS staff includes mammalogists, ornithologists, limnologists, pathologists, a biometrician and a pesticides unit. The head office is in Ottawa; regional offices are located in Edmonton and Ottawa, with smaller offices across Canada, from Whitehorse, Yukon Territory, to St. John's Newfoundland.

CWS administers over 90 migratory bird sanctuaries throughout Canada and it is participating with the provinces in a major program of preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program, in effect since April 1966, provides for expanded research and management in co-operation with the provincial game agencies and other interest organizations.

For further information on wildlife in your province, please contact the director of your provincial fish and wildlife department.

Written for the Canadian Wildlife Service
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Photo by Arne Maki
Issued under the authority of the Honourable
Jean Chrétien, PC, MP
Minister of Indian Affairs and Northern Development
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Catalogue No. R69-4/5
Design: Gottschalk & Ash Ltd.

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American Robin



The American Robin (*Turdus migratorius*), one of the best known birds in North America, was so named by the early colonists because, although much larger (about 10 inches) it reminded them of the English Robin. The male has a cinnamon-rufous to brick-red breast — by which it is most commonly recognized — a black head, white eyerings, yellow bill, black and white streaked throat and grey back. The female is duller and paler.

Newly hatched young robins are red-skinned and nearly naked, but soon assume a mouse-grey natal down. Later they grow feathers and resemble their mother, except for black spots on their breasts and pale streaks on their bodies. Between early August and mid October, these immature birds replace their feathers (post-juvenile moult), except those on the wings and tail. This first winter plumage is similar to that of the adults but colours are duller, more veiled and browner above. By spring, the plumage is brighter: breast redder, head blacker, throat more clearly black and white. The brightening of the feathers is caused not by moulting, but by wearing of the duller edges of the feathers. After breeding these young birds undergo their first post-breeding moult, between late July and early October, and at this stage they cannot be told apart from their elders.

Distribution

The robin breeds north to the limit of trees in Alaska, across Canada, and southward into southern Mexico and the Gulf Coast of the United States. Northern populations are migratory, spending the winter mainly from southwest British Columbia down the Pacific coast, through the central United States, up the east coast as far as Massachusetts, and southward to northern Mexico, southern Texas and the tip of Florida. The southern races in the eastern United States and in Mexico are non-migratory. In Canada, robins range from the northern Yukon and Mackenzie through southern Keewatin, northern Manitoba,

northern Quebec, to upper Labrador, and southward. Some birds winter as far north as central Ontario and Newfoundland.

Environment

The robin was originally a forest species, but has advanced into residential areas where we see it regularly on our lawns and nesting in our gardens and city parks. This bird prefers semi-open areas, but still frequents fairly deep woods. It also ascends mountain forests to 12,000 feet, often to meadows above the timber line. It has invaded the prairies, as trees have been planted, so that there is scarcely any type of habitat, except typical marshes, where it will not nest. It prefers to winter in open areas, but does frequent pinewoods and orange groves.

Food and feeding habits

Most of us have seen robins on our lawns, digging for and pulling up worms. However, earthworms provide only a small part of the robin's diet. The robin eats many kinds of soft foods. Although insects — such as earthworms, beetles and caterpillars — provide about 40 per cent of its diet, the robin is chiefly a fruit-eating species with choke cherries, barberries and rowan berries high on its list. Other favourites are sweet and sour cherries, wine grapes and tomatoes. Robins also eat small snakes, they comb the seashore at low tide for molluscs and will go belly deep in water to pick up fish fry. Although robins chiefly glean their food on the ground when hunting insects, or perch in trees while stripping fruit they can also catch flying insects in mid air.

Young birds in the nest are fed mostly on earthworms and cutworms. Each bird eats approximately three pounds of food in a two-week period.

Life history and breeding habits

The robin is a day migrant, beginning its northward movement in late February and not arriving in any numbers in Canada until early March. The temperature rise in spring is a key factor, for the bird needs thawing ground so that it can dig up earthworms. It is known that they follow closely an average daily temperature of 37°F.

Usually, flocks of up to a dozen males arrive first as the snow recedes; females sometimes arrive the same day but are usually a week, or even more, behind their mates. Spring arrival may occur from early March through late April in southern areas of Canada and up to mid May in northern localities.

Males often select their territories before the females arrive and carolling may suggest advertisement, though no authority is sure of this. Birds return to the same general area each year, but young birds may move up to a mile away.

The size of territory ranges from about 2,000 square feet to one-third of an acre. The popula-

||||| Wintering range
Breeding range





tion density is highest in the dense vegetation of semi-rural areas. Males frequently fight over territory in the early nesting season. Some females also defend the territory but more particularly the nest itself. Birds occasionally exchange mates with each clutch, and may have more than one mate during a breeding season.

Courtship is hard to define in the robin and usually takes place on the ground. Numerous fights occur during this period. Courtship includes courtship feeding and three types of singing. These are the carol song, the territory song and the mating song.

Singing from song perches is done by the male, mostly in the morning and most frequently during the period of courtship. Males will also sing when the young are in the nest and at night, but carolling generally decreases after pair formation. The familiar "cheer-up" or "cheerily" is the carol song. The territory or whisper song is similar to carolling but is soft and ventriloquistic. The mating song is similar and is accompanied by the male displaying and lifting his tail higher than his head. Robins have a variety of notes from the well-known alarm "cheep" and disturbed "tuk-tuk" to a scolding chirp accompanied by tail jerking. In social groups they make a "ha-ha-he-hi-hi-ha-ha" noise; and in flight, especially on migration, give a "tseup" note. Singing continues into late July, infrequently to September and occasionally into winter. Female robins do not sing, but give alarm notes during the breeding season. Whether they call in social groups or on migration is not known.

The breeding season is from early April to as late as September. Either or both birds may choose the nest site: in a typical tree crotch, on a post, a building ledge or a fish flake (rack for drying fish), or such unlikely places as an iron beam of a railway trestle, a railway flatcar, a rail-crossing gate, or trolley wires. They have used 56 species of trees, though they prefer spruce and maple, 21 species of shrubs and vines, and over 21 man-made sites. They have often used nests of other species — such as the Eastern Phoebe, the Catbird, the Common Grackle and the Baltimore Oriole — nests on the ground and nests from the previous year. Robins also build one nest on another; two- and three-storey nests are fairly common and one six-storey nest has been recorded. In such cases, the lower nest, or nests, serves as a structural base and the eggs are laid in the new nest at the top.

The female makes the cup-shaped nest of mud (clay, sand-muck or muck) mixed with grasses or small twigs and also, frequently, with string, rope, and scraps of cloth and tissue paper. She works mud into place with her feet and bill, moulds it with her body and lines the nest with fine grass. She takes from two to six days to build the nest, making an average of 180 trips a day, with mud or grass, during the peak building pe-

riod. If the weather is bad, she may not occupy the nest for as many as 20 days. The nest measures 3 to 6½ inches on the outside and 2½ to 4 inches on the inside, weighs about 8½ ounces and is usually placed about 10 feet above ground, though the height may range from 14 inches to 62 feet.

In southern Canada, the first clutch is laid in late April or early May. This is commonly followed by a second clutch and, when conditions are favourable, a third clutch is not unusual. Nests may still contain eggs in early August. A clutch of three or four eggs is common, of two or five not unusual, of six rare. Seven or eight eggs are exceptional and are likely to be the work of two females.

The eggs are the familiar robin's-egg blue; though white ones, rarely brown spotted, do occur. Incubation usually takes 12 days but may take 11 to 14 days. The female generally begins sitting after the last egg is laid. The male frequently stands guard when he is not in the feeding area and may occasionally sit on the eggs.

The nestling period is from 13 to 16 days, so the next clutch may be started about 40 days after the first egg of the year. The young are fed an average of 100 meals a day mostly before noon. Feeding may continue all day or well after dusk. The parents keep the nests clean by carrying away or eating the fecal sacs.

Fledglings will move up to 50 yards on the first day of leaving the nest. They may remain in the parents' territory for three weeks and may be fed by the male while his mate is on the next clutch.

Where territories are close together, a nearby feeding and loafing site is shared, or birds may travel up to one-quarter of a mile to feed. Young birds disperse from mid May to late September. Earlier broods follow the parents to the feeding areas and also join the roosting group. Three types of roosts are used. Spring roosts are used from the end of April to mid July. These are primarily male domains with much chorus singing but no territorial behaviour. Females may join the spring roosts before and after the breeding season. Autumn roosts are used by migrating birds until the leaves fall. Winter roosts may be as large as one square mile. They are noisy places filled with thousands of birds, often in full carol. The feeding area may spread out over a 12-mile radius from the winter roost.

Autumn departure begins in early September; but the main movement is in October, with a noticeable peak in southern Canadian areas in November. A few birds pass through southern Canada as late as the second week of December. The birds usually migrate in small flocks but may sometimes do so in flocks of several hundreds, frequently with Blue Jays. In winter, robins share the edge of huge Red-winged Blackbird roosts with Common Grackles and starlings and feed with Cedar Waxwings.



Enemies

Robins have many enemies. The chief one in residential areas is the domestic cat. Man used to be an enemy, shooting birds in the fall for the pot. Farmers still shoot them in orchards or in tomato or blueberry fields to prevent damage to the crops, but must obtain a federal Damage-Kill Permit to do so, as these birds are protected under the Migratory Birds Convention Act. In winter roosting areas, bobcats and Great Horned and Barred Owls take a toll. Other enemies include the raccoon, grey and red squirrels, chipmunks, hawks (especially the Sharp-shinned), crows, jays, grackles and snakes.

Robins are evicted from their homes by House Sparrows, who build roofs over the nests, and by Mourning Doves. Shrikes sometimes attack robins but whether they are successful in killing them is not known. Robins will not tolerate Cowbirds laying eggs in their nests, and such parasitism occurs very rarely. External parasites include lice, flies, ticks and mites.

Management problems

Robins do considerable damage to cherry and grape crops, and to olive orchards and tomato fields while on their wintering grounds. A Canadian Wildlife Service biologist has studied methods of scaring birds away from fruit crops. He has found no effective and economical method. Acoustic bird-scaring devices — such as Av-Alarm — shooting, and netting of grape vines are effective, but these cost far more than the damaged crop. Robins also spread poison ivy seeds.

On the other hand, robins play an important part in controlling insects — for example, during outbreaks of alfalfa weevils — by eating them in large quantities and feeding them almost exclusively to their nestlings.

Despite some detrimental characteristics, the robin is still the best loved bird in North America and the harbinger of spring to most communities in Canada.

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Bat



Approximately a dozen species of bats are found in Canada. Like other mammals, they are warm-blooded and give birth to their young and suckle them. They have fur but are unique among mammals in their ability to fly, and no other living animal has flight equipment like theirs. It consists of a thin but tough flight membrane that stretches outward from the sides and rear of the body, supported by the arms, legs, and tail. It is reinforced by greatly elongated finger bones. A bat hangs downward when at rest, a position that permits it to start flying by merely releasing its toehold and spreading its wings.

When seen in flight, bats often appear larger than they are. The largest Canadian bat, the hoary bat (*Lasiurus cinereus*), weighs about one and a half ounces, but has a wingspread of about 16 inches. The common little brown bat (*Myotis lucifugus*) weighs approximately one third of an ounce, but has a wingspread of about 10 inches. For comparison, the weight of a house mouse is about one ounce.

Although bats in the tropics have become specialized for diets of fish, fruit, nectar, and even blood, those inhabiting Canada and the continental United States live exclusively on insects. These are caught while flying, and include moths, beetles, mosquitoes, and even smaller insects. Birds that catch flying insects do so with their mouth, but bats scoop their victims into the flight membrane, temporarily folded into a pouch, then seize them with their jaws. Although this is a complicated manoeuvre, bats have been observed making two successful catches within one second. Some of the typically erratic flight of bats is the result of such feeding activity.

Bat's eyes, which are relatively small, are of little if any use to them in feeding. They locate their prey and other objects near them by emitting rapid bursts of cries and pinpointing the source of the echoes. Bats make audible noises, but those employed in echo location are too high pitched to be audible to man. The ability to locate

objects by this technique is not widespread, but is employed by some cave-dwelling birds and a few marine animals, such as porpoises.

Canadian bats are divided into two groups on the basis of behaviour. The common species travel relatively short distances between summer and winter quarters. As these bats usually choose caves in which to hibernate, they are known as cave bats. The others remain active throughout the year, and migrate to warmer climates for the colder months. Unlike the cave bats, which often form colonies in buildings during the summer, these bats normally roost outdoors in trees and shrubs. They are called tree bats.

The map shows the distribution of the little brown bat, the most widely distributed bat in North America. It is a cave bat, and the one whose colonies are most frequently found in buildings. Although tree bats have been captured well north of the limit indicated for the little brown bat, their normal range is within that of the little brown bat. Tree bats are powerful fliers, and stray bats that reach the tundra can survive during its short summer when the tundra abounds with insect life.

Life cycle of the little brown bat

Summer colonies are formed in attics and other dark, hot places. They may consist of as many as several hundred females, which begin arriving early in April. Young are born in June, ordinarily one to each mother. No nest is built, and for several days the young bat, born without noticeable fur, clings with its teeth to its mother, even when she leaves the colony in the evening to feed. As the baby gets larger, it is left behind while the mother hunts. Growth is rapid; within four or five weeks, the baby can fly. Before frost comes it will be full grown and have accumulated enough fat to carry it through the winter. Because few insects can be caught between the time of the first hard frost in the autumn and frost-free days in the spring, its fast may extend from early September until April.

Males remain in the same summer area as the females, but usually do not join the colonies. Most find shelter singly or in small groups under bark, behind shutters, and in other places where the temperature is cooler than in the attic colonies.

When the young have been weaned, bats of both sexes and of all ages scatter about the countryside. Presumably this wandering permits them to find an appropriate place in which to hibernate. They visit a suitable cave briefly, then disperse until they return for good in the autumn. Year after year bats return to the summer colony and winter cave. Mating takes place in the autumn, but implantation is delayed until spring, the sex of the remaining alive in the female's reproductive tract through the winter.

Little brown bats hibernate in clusters on the ceiling or higher parts of cave walls, beyond reach of most predators. Often they pack themselves into cracks and pockets in the rock. Their tem-



perature drops to that of the environment, usually from 40° to 50°F, which helps conserve their energy supply – a layer of fat. From time to time they may rouse. It has been noted, for example, that many may cluster near the entrance early in the winter, but that they move farther into the cave as the temperature drops. Moisture may condense in fine droplets at the tips of hairs of hibernating bats, making them look white in a beam of light.

In the spring, females leave the cave before the males. Their activity brings about the discharge of the egg from the ovary, and fertilization takes place. The usual summer colony, a poorly ventilated attic that becomes very hot when the sun shines, is ideal for the embryo, which develops faster at higher temperatures. In the attics, as in the caves, the bats squeeze into crevices or crowd together in clusters. At dusk they emerge, apparently thirsty, for they usually fly at once to water, and drink by skimming the surface. Most colonies of little brown bats are close to rivers, lakes, or ponds, which provide not only water but many of the insects on which they feed.

Although two 24-year-old bats have been reported, their average life span is perhaps but three or four years. Young sometimes get separated from their mothers or are abandoned by them. Others fail to get enough reserve fat to carry them through their first winter. The population of little brown bats in Canada is probably greater today than before the country was settled. The bat finds buildings ideal for summer maternity colonies, and abandoned mines quite as acceptable as natural caves for hibernation.

Migration and homing

The distance cave bats travel between the winter quarters and the summer area may be as great as 200 miles. The direction of this migration depends on the location of the winter cave. Strangely enough, bats do not always hibernate in the cave nearest to their summer area.

Experiments with the little brown bat have shown that it is a good homer. Even in winter bats removed from the cave and released at a distance get back successfully.

All tree bats leave Canada in the autumn. It is not certain how far they migrate, because their winter range is large, extending from the southern states into Mexico and beyond. During the autumn migration, several have been reported in Bermuda and on ships far out in the Atlantic.

Enemies of bats – control of bats by man

The bat appears to have few enemies. Cats, raccoons, weasels, snakes, owls, and hawks catch some, but man is probably their greatest destroyer today. Bats that get into buildings are killed in large numbers, and many are collected for scientific and public health studies. Unseasonable weather may cause widespread destruction. It is

known, for example, that large numbers have perished during migration when caught in heavy rains. Others have died when the entrance to the cave they sought to enter was blocked by snow. Sudden floods sometimes fill caves, drowning the bats, though they seem to recognize caves that flood regularly and avoid hibernating in them.

Although bats play a useful role by helping to keep insects like mosquitoes under control, they are not popular. Their summer colonies are usually not appreciated by humans who share the buildings with them, for bat droppings are smelly.

Getting rid of bats is often difficult. The main passageways can be discovered by watching the building at dusk when the bats emerge to feed. These can be blocked after the bats have left, or during the months when the bats are not in residence. However, bats are not easily discouraged; they exhibit great reluctance to leave their summer home. If passageways are overlooked, the bats will find them, which means further watching and further blocking. In buildings where blocking passageways is impractical, bats can be discouraged by keeping the area where they congregate well lighted day and night. Pesticides are available which will kill bats. However, because of the dangers to man, poison control should be entrusted to specialists. Fumigation gives only temporary relief; if the quarters remain available, they will be reoccupied.

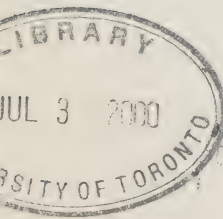
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In 1953 it was first noticed that insect-eating bats can carry the virus of rabies. It is thought that they pick up the virus when they migrate south and come into contact with bats that have a diet of blood. Fortunately, the percentage of infected bats in Canada is low. Some infected bats give no sign of being diseased. Others appear sick, and some become aggressive. Because rabies in man is fatal if permitted to develop to the stage where symptoms are observed, bats should be handled only if precautions are taken to prevent them from biting. Children in particular should be warned against handling bats.

If a person is bitten, he should cleanse the wound *at once* and report to a physician. The nearest federal veterinary authorities (Health of Animals Branch, Canada Department of Agriculture) should be alerted *without delay*. The bat should be caught, if possible, for examination at one of the Department's Animal Pathology Laboratories. Delay could result in a human fatality.

Bat banding

Small numbered metal bands, similar to those used on birds, have been employed in studying the migrations and life span of bats. They are issued by the United States Fish and Wildlife Service, Washington, D.C., for the entire continent, and records of all banding are kept by that agency. Few tree bats have been tagged because of the difficulty in catching them, but thousands of cave



bats have been banded. Bat banders protect themselves against rabies by receiving inoculations.

Ornithologists who find banded bats report them to the U.S. Fish and Wildlife Service, c/o the National Museum, Washington, D.C. If the bat is dead, the band is removed and sent to Washington along with a note on the date and place of capture. If the bat is uninjured, the number is read carefully and the bat released. Little brown bats cannot bite through rubber gloves, but persons handling larger bats wear leather gloves for safety. The Fish and Wildlife Service notifies the finder of the date and place where the bat was originally banded, and also notifies the bander of its recapture.

Much of the information regarding migrations and life span of bats has come through the co-operation of persons who by chance have found banded specimens and reported them. The longest known migration of the little brown bat is an example. The bat was found in a camp stove in Ontario, 200 miles northwest of the banding site in an old iron mine on the shore of Lake Champlain, in New York.

Most of the popular notions about bats are without foundation. "Blind as a bat" is meaningless, for bats have eyes and can see. (Vision is thought to be useful to them chiefly in the recognition of distant objects.) Bats do not get in people's hair, at least not intentionally. And if a bat does land on a person, it does not shed its parasites. Like man himself, bats do have parasites, but they are so specialized for living on bats that they rarely bother man.

Perhaps the next bat you see will be skimming over the surface of a lake on a summer evening. It may even investigate your lure if you are fly-casting. There is no need to be alarmed by it. Because of its hearty appetite for insects it is making your life in the outdoors more enjoyable.

Reading list

- Allen, G. M. 1940. Bats. Harvard University Press. Cambridge.
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How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service, a branch of the Department of Indian Affairs and Northern Development, conducts wildlife research and

management for the federal government. Each province controls the natural resources, including wildlife, within its boundaries. However, because of the Migratory Birds Treaty, signed in 1916 with the U.S.A., the federal government is responsible for management and protection of migratory birds. CWS administers the Migratory Birds Convention Act and Regulations but co-operates with provincial governments in doing so.

CWS studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory and the national parks. Since the institution of the National Wildlife Policy and Program in April 1966, it has been co-operating with provincial game agencies and other organizations in research and management.

The CWS staff includes mammalogists, ornithologists, limnologists, pathologists, a biometrician and a pesticides unit. The head office is in Ottawa; regional offices are located in Edmonton and Ottawa, with smaller offices across Canada, from Whitehorse, Yukon Territory, to St. John's, Newfoundland.

CWS administers over 90 migratory bird sanctuaries throughout Canada and participates with the provinces in a major program for preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

For further information on wildlife in your province, please contact the director of your provincial fish and wildlife department.

Written for the Canadian Wildlife Service
by H. B. Hitchcock

Photo by H. E. Edgerton

Issued under the authority of the Honourable

Jean Chrétien, P.C., M.P.

Minister of Indian Affairs and Northern Development

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Catalogue No. R69-4/12

Design: Gottschalk + Ash Ltd.

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WHO'S WHO

Canada



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Little brown bat in flight. Photo by H. E. Edgerton

Bats

(Myotis lucifugus)

Approximately a dozen species of bats are found in Canada. Like other mammals, they are warm-blooded and give birth to their young and suckle them. They have fur but are unique among mammals in their ability to fly, and no other living animal has flight equipment like theirs. It consists of a thin but tough flight membrane that stretches outward from the sides and rear of the body, supported by the arms, legs, and tail. It is reinforced by greatly elongated finger bones. A bat hangs downward when at rest, a position that permits it to start flying by merely releasing its toe hold and spreading its

wings. When seen in flight, bats often appear larger than they are. The largest Canadian bat, the hoary bat, weighs about one and a half ounces, but has a wingspread of about 16 inches. The common little brown bat weighs approximately one third of an ounce, but has a wingspread of about 10 inches. For comparison, the weight of a house mouse is about one ounce.

Although bats in the tropics have become specialized for diets of fish, fruit, nectar, and even blood, those inhabiting Canada and the continental United States live exclusively on insects. These are caught while flying, and include moths, beetles, mosquitoes, and even smaller insects. Birds that catch flying insects do so with their mouth, but bats scoop their victims into the flight membrane, temporarily folded into a pouch, then seize them with their jaws. Although this is a complicated manoeuvre, bats have been observed making two successful catches within one second. Some of the typically erratic flight of bats is the result of such feeding activity.

Bat's eyes, which are relatively small, are of little if any use to them in feeding. They locate their prey and other objects near them by emitting rapid bursts of cries and pinpointing the source of the echoes. Bats make audible noises, but those employed in echo location are too high pitched to be audible to man. The ability to locate objects by this technique is not widespread, but is employed by some cave-dwelling birds and a few marine animals, such as porpoises.

Canadian bats are divided into two groups on the basis of behaviour. The common species travel relatively short distances between summer and winter quarters. As these bats usually choose caves in which to hibernate, they are known as cave bats. The others remain active throughout the year, and migrate to warmer climates for the colder months. Unlike the cave bats, which often form colonies in buildings during the summer, these bats normally roost outdoors in trees and shrubs. They are called tree bats.

The map shows the distribution of the little brown bat, the most widely distributed bat in North America. It is a cave bat, and the one whose colonies are most frequently found in buildings. Although tree bats have been captured well north of the limit indicated for the little brown bat, their normal



range is within that of the little brown bat. Tree bats are powerful fliers, and stray bats that reach the tundra can survive during its short summer when the tundra abounds with insect life. That bats rarely penetrate into this region is shown by the Eskimos' ignorance of them. One hunter in the far North, for example, who had killed a polar bear single-handed, without firearms, was reported by a Canadian Wildlife Service scientist to have been terrified by a bat he had impaled on his spear.

Life cycle of the little brown bat

Summer colonies are formed in attics and other dark, hot places. They may consist of as many as several hundred females, which begin arriving early in April. Young are born in June, ordinarily one to each mother. No nest is built, and for several days the young bat, born without noticeable fur, clings with its teeth to its mother, even when she leaves the colony in the evening to feed. As the baby gets larger, it is left behind while the mother hunts. Growth is rapid; within four or five weeks, the baby can fly. Before frost comes it will be full grown and have accumulated enough fat to carry it through the winter. Because few insects can be caught between the time of the first hard frost in the autumn and frost-free days in the spring, its fast may extend from early September until April.

Few adult male little brown bats join the

colonies, though males remain in the same summer area as the females. Most of them find shelter singly or in small groups under bark, behind shutters, and in other places where the temperature is cooler than in the attic colonies. When the young have been weaned, bats of both sexes and of all ages scatter about the countryside. Presumably this wandering permits them to find an appropriate place in which to hibernate. They visit a suitable cave briefly, then disperse until they return for good in the autumn. Year after year bats return to the same summer colony and winter cave. Mating takes place in the autumn, but implantation is delayed until spring, the sex cells remaining alive in the female's reproductive tract through the winter.

Little brown bats hibernate in clusters on the ceiling or higher parts of cave walls, beyond reach of most predators. Often they pack themselves into cracks and pockets in the rock. Their temperature drops to that of the environment, usually from 40° to 50°F, which helps conserve their energy supply—a layer of fat. From time to time they may rouse. It has been noted, for example, that many may cluster near the entrance early in the winter, but that they move farther into the cave as the temperature drops. They require a high relative humidity to avoid desiccation. Moisture may condense in fine droplets at the tips of hairs of hibernating bats, making them look white in a beam of light.

In the spring, females leave the cave before the males. Their activity brings about the discharge of the egg from the ovary, and fertilization takes place. The usual summer colony, a poorly ventilated attic that becomes very hot when the sun shines, is ideal for the embryo, which develops faster at higher temperatures. In the attics, as in the caves, the bats squeeze into crevices or crowd together in clusters. At dusk they emerge, apparently thirsty, for they usually fly at once to water, and drink by skimming the surface. Most colonies of little brown bats are close to rivers, lakes, or ponds, which provide not only water but many of the insects on which they feed.

Although two 24-year-old bats have been reported, their average life span is perhaps but three or four years. Young sometimes get separated from their mothers or are aban-

doned by them. Others fail to get enough reserve fat to carry them through their first winter. The population of little brown bats in Canada is probably greater today than before the country was settled. The bat finds buildings ideal for summer maternity colonies, and abandoned mines quite as acceptable as natural caves for hibernation.

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Although bats play a useful role by helping to keep insects like mosquitoes under control, they are not popular. Their summer colonies are usually not appreciated by humans who share the buildings with them, for bat droppings are smelly. Getting rid of bats is often difficult. The main passageways can be discovered by watching the building at dusk

when the bats emerge to feed. These can be blocked after the bats have left, or during the months when the bats are not in residence. However, bats are not easily discouraged; they exhibit great reluctance to leave their summer home. If passageways are overlooked, the bats will find them, which means further watching and further blocking. In buildings where blocking passageways is impractical, bats can be discouraged by keeping the area where they congregate well lighted day and night. DDT, which will kill them, can be applied to the surfaces to which they cling. However, because of the dangers to man, poison control should be entrusted to pest-control specialists. Fumigation gives only temporary relief; if the quarters remain available, they will be reoccupied.

Bats as carriers of rabies

In 1953 it was first noticed that insect-eating bats can carry the virus of rabies. It is thought that they pick up the virus when they migrate south and come into contact with bats that have a diet of blood. Fortunately, the percentage of infected bats in Canada is low. Some infected bats give no sign of being diseased. Others appear sick, and some become aggressive. Because rabies in man is fatal if permitted to develop to the stage where symptoms are observed, bats should be handled only if precautions are taken to prevent them from biting. Children in particular should be warned against handling bats. If a person is bitten, he should cleanse the wound at once and report to a physician. The bat should be caught if possible and sent to a public health laboratory for examination. Fortunately, infection can usually be prevented if the bitten person receives prompt medical treatment. This consists of inoculations of vaccine and immune serum.

Bat banding

Small numbered metal bands, similar to those used on birds, have been employed in studying the migrations and life span of bats. They are issued by the United States Fish and Wildlife Service, Washington, D.C., for the entire continent, and records of all banding are kept by that agency. Few tree bats have been tagged because of the difficulty in catching them, but thousands of cave bats have been banded. Bat banders pro-

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The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Migratory Birds Convention Act and Regulations for the federal government. In practice, federal and provincial governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's National Parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a pesticide investigator, and a biometrician. The head office is in Ottawa and there are regional offices in Edmonton and Ottawa. Smaller offices are located at Fort Smith and Inuvik, Northwest Territories; Whitehorse, Yukon Territory; Vancouver, British Columbia; Calgary, Alberta; Saskatoon, Saskatchewan; Winnipeg, Manitoba; Aurora, Ontario; Ste-Foy, Quebec; Fredericton and Sackville, New Brunswick; Halifax,

Nova Scotia; and St. John's, Newfoundland.

The Service administers 94 migratory bird sanctuaries throughout Canada. It is now participating with the provinces in a major program of preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program was announced on April 6, 1966, that provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province please contact your chief provincial game officer.

Additional notes

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WHO'S WHO



Beaver

(*Castor canadensis*)

No other animal has influenced a nation to the extent that the beaver has influenced the development of Canada. Champlain pushed westward to extend the beaver trade of New France in 1613. Radisson and Des Groseilliers went onward to the Lake Superior and James Bay regions in the period 1659 to 1661 in search of beaver. The Hudson's Bay Company established the northern fur trade in 1670. The Nor'westers, operating out of Montreal after 1783, went to the farthest reaches of Canada in search of beaver. We have recognized the beaver as a national symbol on stamps, coins, and emblems; we have named literally hundreds of lakes, towns, rivers, and hill ranges after the beaver.

Distribution and physical characteristics

Beaver are found throughout Canada, north to the mouth of the Mackenzie River on the Arctic Ocean, but they are seen only occasionally on the tundra of the North. Even on the high, dry, upland prairie of Saskatchewan and Alberta,



CANADIAN WILDLIFE SERVICE

wherever streams and deciduous (broad-leaved) trees or shrubs are found, the beaver is likely to be found also.

Its North American range extends through most of Alaska, and at one time included most of Continental United States and a portion of Northern Mexico. It has been exterminated in many states, but others contain thriving populations.

In the 12th century beaver were found in England and Wales, and throughout Eurasia at least as far east as the Yenisei River and as far south as Spain and Italy. It became extinct in the British Isles a century or so after the Norman conquest. By the early 1900's only a few remained in Eurasia, mainly in small colonies on the remote reaches of a few northern rivers of the U.S.S.R.

The beaver is the largest rodent in North America, and is the largest in the world except for the capybara of South America. At one time, in the Pleistocene period—the era of the mastodons and mammoths—giant beaver were found in North America. Their length including tail was probably about nine feet, and they may have weighed 800 pounds.

Present day beaver are much smaller. Adults average 40 to 60 pounds. Exceptionally large ones reach 100 pounds. Including its 12- or 13-inch tail a large beaver may be four feet long.

An early writer named Wood described the beaver's appearance quaintly but accurately: "His shape is thick and short, having likewise short legs, feet like a mole before, and behind like a goos, and a broad taylor in forme like a shoo-soale, very tough and strong; his head is something like an Otter's head, saving that his teeth before, be placed like the teeth of a Rabbit, two above and two beneath; sharpe and broad with which he cuts down trees as thick as a man's thigh."

Very compact and rotund, the beaver when in walking stance on land appears to have no neck at all, the round profile of the head merging into the round profile of the back. The eyes are quite small and beady, and the beaver sees moderately well both under water and above water. The hind feet are very large, with five long blunt-clawed toes which are fully webbed for swimming. The two inside claws on each hind foot are double, with upper and lower sections which are movable and come together like tiny pliers. These claws are used for combing the fur. The front feet are small, without



webs, and the toes end in long sharp claws suited to digging.

The front paws are very dexterous—almost like hands, and with them the beaver can hold and carry sticks, stones, and mud, and perform a variety of complex construction tasks.

Only the hind feet are used to propel the animal through the water, occasionally with some aid from the tail. The broad hind feet provide good support on soft muddy ground. The legs are short, and on land the beaver is ungainly and slow. When frightened it can travel quite quickly in an awkward bounding gallop, but over a distance of a few hundred feet a man can run a beaver down. In the water it is a graceful, strong swimmer, both under water and on the surface.

Its sense of smell is acute. The nostrils are small and can be closed for underwater swimming. Hearing is also excellent, and the ears, too, are valvular and become tightly closed under water.

The beaver's long, sharp, strong incisors consist of material that is hardest on the forward face. Consequently, as the teeth wear away with constant gnawing, the outer tips of the incisors remain chisel-sharp. With them a beaver is able to fell very large trees—the largest on record being 46 inches in diameter. The lips can be closed behind the incisors, permitting the beaver to gnaw under water.

When swimming under water the beaver

uses its tail as a four-way rudder. The tail of a large beaver may be 12 inches long, perhaps six or seven inches wide, and one and one-half inches thick. It is covered with leathery scales and sparse, coarse hairs. The tail contains a good deal of fat, but it is flexible and very muscular and strong. When diving after being frightened, a beaver slaps the water with its tail, making a noise like a pistol shot, which warns all beaver in the vicinity that danger is near. The tail acts as a prop when the beaver is sitting upright to gnaw through a tree trunk, and acts as a counter-balance and support when the animal is walking on its hind legs carrying building materials like mud, stones, or branches in its front paws.

The fur is very dense, consisting of a mat of very fine underfur about three-quarters of an inch long, and an outer layer of heavy guard hairs about two and one-half inches long. Through constant combing and oiling this dense pelt is kept waterproof. Even after swimming under water for six or seven minutes the beaver is not wet to the skin. Oil is obtained from two glands near the anus, and combing and application of oil is done with both front and hind feet; the combing claws being used to straighten kinks and snarls, and perhaps to comb mites and other insect parasites out of the fur.

Engineering works

There are many false legends about the beaver, such as the one that credits him with the intelligence to fell a tree in the direction he chooses, like an expert lumberjack. In actual fact, a fair proportion of trees felled by beaver fall against a nearby tree and remain more or less upright. Early writings about the beaver insist that the animal uses its tail as a trowel. This is not so. The front paws are used to plaster mud on dams and lodges.

But the actual feats of the beaver are impressive enough that legends are not necessary. The dam itself is an extraordinary piece of construction. The purpose of the dam is to create a pond deep enough that it will not freeze to the bottom during the coldest winter, and which will provide deep-water storage for the winter food supply—deep enough that most of the sticks and twigs of the food cache are below the ice.

The dam is begun by laying sticks in the stream bed with the butt end imbedded in the

bottom mud and the other end pointing downstream so the branches act as anchor prongs in the mud. Twigs, mud, stones, and any other movable materials are laid in place in front of and around the first rows of sticks, and the eventual result is a very stable earthwork which can withstand great water pressure and erosion by running water. Dams 18 feet in height have been discovered. Often such high dams are “backed up” by secondary dams downstream, which raise the water level on the downstream side of the main dam, thus reducing the tremendous water pressure against the upstream side.

A beaver family of five or six may require an acre of dense poplar trees for its food supply each year. As trees are cleared away from the edge of the pond, the beaver go farther and farther afield in their logging operation—often 400 feet or more from the pond. They cut down trees and shrubs, and make logging trails so they can drag heavy sticks overland more easily. Their most impressive feat in transportation is the building of canals. Canals may extend several hundred feet along the base of a wooded hillside. Often three feet wide and a couple of feet deep, the canals provide easy transportation of food supplies. Sometimes canals are dammed to maintain the water level on uneven ground, and occasionally nearby streams are diverted into canals to maintain the water level.

Many beaver houses are merely burrows in a stream bank; others are “lodges” built in the beaver pond or on an adjacent shore. Most lodges are about 15 feet in diameter and five or six feet high, with a single living compartment four or five feet in diameter and about two feet high. Lodges 27 feet in diameter have been discovered. Some of the larger ones have more than one apartment—each apartment usually occupied by a separate family group. Lodges are made up mainly of intertangled sticks and twigs, and as freezing weather begins the beaver plaster them with mud, making a concrete-like outer coat which no wolf, wolverine, or lynx can break through. Each family compartment has two openings, both under water, for exit and entry.

Life history

Beaver are monogamous, and mate for life. Kits, averaging three to four per litter, are usually born in June, but sometimes as late as

September. They are well-furred when born, with teeth already cut—exact miniatures of their parents. The young stay with their parents until they are two years old, at which time they are driven away from the pond, and migrate along streams or across country until they find mates and suitable building sites, whereupon they establish their own dam and house.

Dam building is often done in August, but beaver will repair a break in their dam whenever possible. House-building comes later, perhaps in September. As the first frosts of October occur, the tempo of beaver life speeds up as they harvest their winter food supply. Trees are cut down, gnawed into short lengths, and toted to the pond, for underwater storage. All winter the beaver bring sticks from their underwater cache into the lodge to gnaw the succulent bark, at a rate of about 20 ounces of bark a day for an adult beaver.

The otter is an important predator, being able to enter the lodge via the water and kill the beaver inside. Wolverine, wolf, and lynx occasionally surprise beaver on land. Mink take beaver kits quite frequently, and hawks and owls take them occasionally.

The beaver fur trade and beaver management

In the early days of the fur trade, up to 170,000 pelts a year were sold in London and Edinburgh, most of them being used for felt to make the then-popular beaver hats, valued at 80 or 90 shillings. A very large adult beaver skin might yield enough fur for 18 hats. The standard price in eastern North America was \$4.00 per pelt in the later years of the trade, but the Indian trapper might trade a skin for a few cheap knives or a drink of rum.

After the turn of the century, the trade in beaver declined, partly with the decline of the beaver hat as fashionable headwear, and partly because the beaver themselves were becoming scarcer all over North America. Many large regions were completely without beaver during most of the first half of this century. More recently, sensible conservation plans have been put into effect by the Federal and Provincial Governments, with the co-operation of the trappers. Beaver have been reintroduced into many areas that were stripped by early trappers. As recently as 1954, the Canadian Wildlife Service flew nearly 100 beaver into an area north of Great Slave Lake in the Northwest Territories.

As a result of reintroductions and improved trapping laws, there has been a tremendous upsurge in the number of beaver in Canada. In Saskatchewan, for example, the annual catch rose from about 500 in the 1940's to several thousand in the 1950's. In some areas the problem is not how to protect the beaver population, but to harvest enough to prevent over-population and starvation due to over-consumption of food supplies. In the 1962-63 trapping season, 436,780 beaver pelts were marketed in Canada, and the average value was \$12.48.

The multitudes of beaver on the headwaters of our major streams stabilize stream flow, prevent stream bed erosion, create trout ponds, and improve habitat for many forms of wildlife. They are nature's great conservationists and are valuable fur bearers, as well as a source of food for trappers. They merit careful study and intelligent management.

How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Act for the Federal Government. In practice, Federal and Provincial Governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's National Parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

For further information on wildlife in your province please contact your chief provincial game officer.

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OUR FILE NO.

Beaver



No other animal has influenced a nation to the extent that the beaver (*Castor canadensis*) has influenced the development of Canada. Champlain pushed westward to extend the beaver trade of New France in 1613. Radisson and Des Groseilliers went onward to the Lake Superior and James Bay regions in the period 1659 to 1661 in search of beaver. The Hudson's Bay Company established the northern fur trade in 1670. The Nor'westers, operating out of Montreal after 1783, went to the farthest reaches of Canada in search of beaver. We have recognized the beaver as a national symbol on stamps, coins, and emblems; we have named literally hundreds of lakes, towns, rivers, and hill ranges after the beaver.

Distribution

Beaver are found throughout Canada, north to the mouth of the Mackenzie River on the Arctic Ocean, but they are seen only occasionally on the tundra of the North. Even on the high, dry, upland prairie of Saskatchewan and Alberta, wherever streams and deciduous (broad-leaved) trees or shrubs are found, the beaver is likely to be found.

Its North American range extends through most of Alaska, and at one time included most of continental United States and a portion of northern Mexico. It has been exterminated in many states, but others contain thriving populations.

In the 12th century beaver were found in England and Wales, and throughout Eurasia at least as far east as the Yenisei River and as far south as Spain and Italy. It became extinct in the British Isles a century or so after the Norman conquest. By the early 1900's only a few remained in Eurasia, mainly in small colonies on the remote reaches of a few northern rivers of the U.S.S.R.

Physical characteristics

The beaver is the largest rodent in North America, and is the largest in the world except for the capybara of South America. At one time, in the



Pleistocene period – the era of the mastodons and mammoths – giant beaver were found in North America. Their length including tail was probably about nine feet, and they may have weighed 800 pounds.

Present-day beaver are much smaller. Adult average 40 to 60 pounds. Exceptionally large ones reach 100 pounds. Including its 12- or 13-inch tail, a large beaver may be four feet long.

An early writer named Wood described the beaver's appearance quaintly but accurately: "*His shape is thicke and short, having likewise short legs, feet like a mole before, and behind like a goos, and a broad taylor in forme like a shoosole, very tough and strong; his head is something like an Otter's head, saving that his teeth before, be placed like the teeth of a Rabbit, two above and two beneath; sharpe and broad with which he cuts down trees as thick as a man's thigh.*"

Very compact and rotund, the beaver when in walking stance on land appears to have no neck at all, the round profile of the head merging into the round profile of the back. The eyes are quite small and beady, and the beaver sees moderately well both under water and above water.

The hind feet are very large, with five long blunt-clawed toes which are fully webbed for swimming. The two inside claws on each hind foot are double, with upper and lower sections which are movable and come together like tiny pliers. These claws are used for combing the fur. The front feet are small, without webs, and the toes end in long sharp claws suited to digging.

The front paws are very dexterous – almost like hands – and with them the beaver can hold and carry sticks, stones, and mud, and perform a variety of complex construction tasks.

Only the hind feet are used to propel the animal through the water, occasionally with some aid from the tail. The broad hind feet provide good support on soft muddy ground. The legs are short and on land the beaver is ungainly and slow. When frightened, it can travel quite quickly in an awkward bounding gallop, but over a distance of a few hundred feet a man can run a beaver down. It is a graceful, strong swimmer, both under water and on the surface.

Its sense of smell is acute. The nostrils are small and can be closed for underwater swimming. Hearing is also excellent, and the ears, too, are valvular and become tightly closed under water.

The beaver's long, sharp, strong incisors consist of material that is hardest on the forward face. Consequently, as the teeth wear away with constant gnawing, the outer tips of the incisors remain chisel-sharp. With them a beaver is able to fell very large trees – the largest on record being 46 inches in diameter. The lips can be closed behind the incisors, permitting the beaver to gnaw under water.

When swimming under water the beaver uses its tail as a four-way rudder. The tail of a large beaver may be 12 inches long, perhaps six or

seven inches wide, and one and one-half inches thick. It is covered with leathery scales and sparse, coarse hairs. The fat tail is flexible and very muscular and strong. When diving after being frightened, a beaver slaps the water with its tail, making a noise like a pistol shot, which warns all beaver in the vicinity that danger is near. The tail acts as a prop when the beaver is sitting upright to gnaw through a tree trunk, and acts as a counterbalance and support when the animal is walking on its hind legs carrying building materials like mud, stones, or branches in its front paws.

The fur is very dense, consisting of a mat of very fine underfur about three-quarters of an inch long, and an outer layer of heavy guard hairs about two and one-half inches long. Through constant combing and oiling this dense pelt is kept waterproof. Even after swimming under water for six or seven minutes the beaver is not wet to the skin. Oil is obtained from two glands near the anus, and combing and application of oil are done with both front and hind feet; the combing straightens kinks and snarls in the fur, and perhaps removes mites and other insect parasites.

Engineering works

There are many false legends about the beaver, such as the one that credits him with the intelligence to fell a tree in the direction he chooses, like an expert lumberjack. In fact, a fair proportion of trees felled by beaver fall against a nearby tree and remain more or less upright. Early writings about the beaver insist that the animal uses its tail as a trowel. This is not so. The front paws are used to plaster mud on dams and lodges.

But the actual feats of the beaver are impressive enough that legends are not necessary. The dam itself is an extraordinary piece of construction. The purpose of the dam is to create a pond deep enough that it will not freeze to the bottom during the coldest winter, and which will provide deep-water storage for the winter food supply – deep enough that most of the sticks and twigs of the food cache are below the ice.

The beaver begins the dam by laying sticks in the stream bed with the butt end imbedded in the bottom mud and the other end pointing downstream so the branches act as anchor prongs in the mud. Twigs, mud, stones, and any other movable materials are laid in place in front of and around the first rows of sticks. The eventual result is a very stable earthwork which can withstand great water pressure and erosion by running water. Dams 18 feet in height have been discovered. Often such high dams are “backed up” by secondary dams downstream, which raise the water level on the downstream side of the main dam, thus reducing the tremendous water pressure against the upstream side.

A beaver family of five or six may require an acre of dense poplar trees for its food supply each year. As trees are cleared away from the edge of the pond, the beavers go farther and farther afield

in their logging operation – often 400 feet or more from the pond. They cut down trees and shrubs, and make logging trails so they can drag heavy sticks overland more easily. Their most impressive feat in transportation is the building of canals. Canals may extend several hundred feet along the base of a wooded hillside. Often three feet wide and a couple of feet deep, the canals provide easy transportation of food supplies. Sometimes canals are dammed to maintain the water level on uneven ground, and occasionally nearby streams are diverted into canals to maintain the water level.

Many beaver houses are merely burrows in a stream bank; others are “lodges” built in the beaver pond or on an adjacent shore. Most lodges are about 15 feet in diameter and five or six feet high, with a single living-compartment four or five feet in diameter and about two feet high. Lodges 27 feet in diameter have been discovered. Some of the larger ones have more than one compartment, each usually occupied by a separate family group. Lodges are made up mainly of intertangled sticks and twigs, and as freezing weather begins the beaver plaster them with mud, making a concrete-like outer coat which no wolf, wolverine, or lynx can break through. Each compartment has two openings, both under water, for exit and entry.

Life history

Beaver have only one mate, which they keep for life. Kits, averaging three to four per litter, are usually born in June, but sometimes as late as September. They are well-furred when born, with teeth already cut – exact miniatures of their parents. The young stay with their parents until they are two years old. At that time they are driven away from the pond, and migrate along streams or across country until they find mates and suitable building sites, whereupon they establish their own dam and house.

Dam building is often done in August, but beaver will repair a break in their dam whenever possible. House-building comes later, perhaps in September. As the first frosts of October occur, the tempo of beaver life speeds up as they harvest their winter food supply. Trees are cut down, gnawed into short lengths, and toted to the pond, for underwater storage. All winter the beaver bring sticks from their underwater cache into the lodge to gnaw the succulent bark, at a rate of about 20 ounces of bark a day for an adult beaver.

The otter is an important predator, being able to enter the lodge via the water and kill the beaver inside. Wolverine, wolf, and lynx occasionally surprise beaver on land. Mink take beaver kits frequently, and hawks and owls take them occasionally.

The beaver fur trade and beaver management

In the early days of the fur trade, up to 170,000 pelts a year were sold in London and Edinburgh,



most being used for felt to make the then-popular beaver hats. A very large adult beaver skin might yield enough fur for 18 hats.

After the turn of the century, the trade in beaver declined, partly with the decline of the beaver hat as fashionable headwear, and partly because the beaver themselves were becoming scarcer all over North America. Many large regions were completely without beaver during most of the first half of this century. More recently, sensible conservation plans have been put into effect by the federal and provincial governments, with the co-operation of the trappers. Beaver have been reintroduced into many areas that were stripped by early trappers. As a result of reintroductions and improved trapping laws, there has been a tremendous increase in the number of beaver in Canada. In some areas the problem is not how to protect the beaver population, but to harvest enough to prevent over-population and starvation due to over-consumption of food supplies. In 1966, 415,261 beaver pelts were marketed in Canada. Their total value was about \$5 million.

The multitudes of beaver on the headwaters of our major streams stabilize stream flow, prevent stream bed erosion, create trout ponds, and improve habitat for many forms of wildlife. They are nature's great conservationists and are valuable fur bearers, as well as a source of food for trappers. They merit careful study and intelligent management.

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The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province controls the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Migratory Birds

Convention Act and Regulations for the federal government. In practice, federal and provincial governments co-operate in all matters concerning migratory birds. CWS studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's national parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The CWS staff includes mammalogists, ornithologists, limnologists, pathologists, a biometrician and a pesticides unit. The head office is in Ottawa; regional offices are located in Edmonton and Ottawa, with smaller offices across Canada from Whitehorse, Yukon Territory, to St. John's, Newfoundland.

CWS administers over 90 migratory bird sanctuaries throughout Canada and participates with the provinces in a major program for preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program, in effect since April 1966, provides for expanded research and management in co-operation with the provincial game agencies and other interest organizations.

For further information on wildlife in your province, please contact the director of your provincial fish and wildlife department.

Biodiversity



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Environment
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Canada

In 1992, Canada ratified the United Nations Convention on Biological Diversity, as did many other countries. This convention is necessary because the present rate of loss of biological diversity, or “biodiversity,” is a serious global environmental threat.

Just what is biodiversity, and what does it have to do with wildlife? Why is biodiversity important? How much is it declining globally and in Canada? And what can be done to protect it?

What is biodiversity, and what does it have to do with wildlife?

Biodiversity means the variety of life on Earth. It is measured as the variety within species (genetic diversity), the variety between species, and the variety of ecosystems.

Diversity is a characteristic of life everywhere on Earth, from the ocean floor to inside the human gut, and at every geographical scale, from the global to the microscopic. We see this diversity around us every day. We see genetic traits in people, in our pets, and in plants. We know, firsthand if we are lucky, the rich variety of mammal, bird, fish, and plant species in the world. And some of us have lived in strikingly diverse ecosystems — in coastal forests and on arctic tundra, in cities and on farms. However, all this is only a small part of the diversity of life.

Remarkably little is known about biological diversity. One reason is that most species (and many ecosystems) are a lot smaller than humans. Furthermore, each species, whether a tiny virus or a huge humpback whale, has its own genetic diversity, which, in an average species, involves millions of different pieces of genetic material. And to map the genetic code of even one species is an enormous undertaking.

About 1.6 million of the world’s species have been described. Estimates of the total

number of species range from 12 to 118 million. The numbers for known and total estimated species are continually being revised. Viruses are almost entirely unknown. About 1 million of the known 1.6 million species are insects, and *millions* of insect species are *still* unclassified. Some 360 000 algae, fungi, and vascular plants have already been described, and botanists estimate that there are at least another million left to be classified. Animals like nematodes (e.g., worms) and crustaceans (e.g., shrimp-like animals) are not well known. Our knowledge of mammals and birds is much more complete, but “new” species — species previously unknown to science — are occasionally discovered. For example, a new primate (the black-faced lion tamarin) was found in 1990, a new whale (the pygmy beaked whale) in 1991. And as scientists probe unexplored areas of the planet, they continue to find new species, all with unique gene pools, belonging, in some cases, to hitherto unknown ecosystems. Thanks to deep-sea vessels and cameras, bacteria and higher life forms (e.g., worms) have recently been discovered in the ultra-hotwater vents, kilometres below the ocean surface, where no life was thought to be possible.

You do not need to visit exotic places, however, to see strange, unknown organisms and unfamiliar ecosystems. A look through a microscope at ordinary soil reveals countless (mostly nameless!) microorganisms, in addition to the worms and insects that can be seen with the naked eye. Figure 1 shows a few of the underappreciated life forms found in the soil of a deciduous forest in eastern Canada. The oribatid soil mite shown in the drawing is one of the most common soil mites in Canada, but it has not yet been scientifically studied or given a scientific name. Soils are, in fact, complex ecosystems. For example, fungi on tree roots help trees absorb nutrients. And without the insects, fungi, earthworms, and bacteria that transform dead plants and animal carcasses into soil, piled up dead matter would quickly smother all but a few strong-growing trees and bushes!

Wildlife, defined as all wild species, makes up most of the species and genetic diversity of life. Wildlife includes more than mammals and birds living in wilderness areas. Each form of virus, soil organism, plankton, and insect, no matter where it lives, is a wild species, as are the species of parasites and microorganisms that live in such places as under human fingernails and on the feather shafts of wild birds. The remainder of species diversity, apart from the human species, is

life forms that we have domesticated: e.g. species and cultivars of crops and garden plants and species and breeds of pets and livestock. However, despite their importance to people and their sometimes huge populations, domesticates account for only a tiny fraction of the millions of existing species and of the genetic diversity within species.

Some people refer to regional ecosystems that seem to have developed without human dominance as “natural” or “evolved” ecosystems: Canadian examples are the ancient temperate rain forest ecosystem on Vancouver Island and an ecosystem found on the untrawled ocean floor. Today, natural ecosystems and “wild lands and waters” (i.e., ecosystems in which humans and wild populations coexist) have become small arks holding a large proportion of the variety of the world’s species and genes, often in small populations.

Canada’s biodiversity

In Canada, people have recorded 71 000 species of plants and animals and estimate that there may be as many again to be discovered. (This is not counting viruses, which microbiologists are only beginning to identify.) Overall, Canada has fewer species than have tropical countries, but it contains species specially adapted to cold climates. It also contains free-ranging populations of large mammals, such as polar bears, grizzlies, caribou, and wolves.

We are fortunate in Canada to have remnants of time-tested natural ecosystems. The most extensive are in the northern and western parts of the country. As well, throughout much of rural Canada there are large areas of wild lands and waters, where people trap, extract oil and gas, build roads and communities, and otherwise carry on with their lives, altering, but not driving out, the original assemblages of species. It should be possible, with proper management, to maintain high levels of ecosystem, species, and genetic diversity in these places.

Almost half of Canada is forest land. About 23% of the country is arctic or alpine tundra. Canadian river runoff to the sea is about 10% of the world’s total fresh water runoff, and Canada has more lakes than any other country, many more than it has been possible to plumb. Canada contains one-quarter of the remaining wetlands on the globe, mostly in vast northern expanses of marsh and bog.

Wetlands in estuaries (of which Canada has an abundance) rank with coral reefs

Cover photos:

1. Bearded seal, Wood Bay, N.W.T. (photo by G.W. Beyersbergen)
2. Gray treefrog (photo by Robert McCaw)
3. Morel (photo by Robert McCaw)
4. Dew bumblebee on a teasel (photo by Robert McCaw)
5. Alpine, grassland, and shoreline ecosystems at Castle River, Alberta (photo by Richard Fyfe)

Figure 1

A few of the small organisms in the soil ecosystem of a deciduous forest in eastern Canada.

1. Oribatid soil mite. The mite is magnified 165 times (165×)
2. Symbiotic union between the fungal hyphae of the fleecy milk cap and the roots of an oak tree (13×)
3. Root aphid feeding on pineapple weed (22×)
4. Oak forest ant tending eggs (7×)
5. Nematodes (roundworms) feeding on roots (22×)
6. Leaf decomposition by bacteria and fungal hyphae, with a protozoan ciliate feeding on the bacteria (1500×)
7. Black widow spider tending an egg sac (2×)
8. Predacious horsefly larva and pupa (1½ ×)

Drawing by Roelof Idema. Specimens and research courtesy of staff at the Canadian National Collection of Insects, Arachnids and Nematodes, Agriculture and Agri-Food Canada.



and intensive agriculture as the most productive ecosystems: in estuarine wetlands a few species of plants grow quickly, providing food and nursery areas to a wide variety of animals. Canada has other species-rich marine ecosystems off its coasts, for example, the Grand Banks off Newfoundland and the kelp forests off British Columbia.

Why is it important that life remain diverse?

For its own sake

The Convention on Biological Diversity recognizes the intrinsic value of biodiversity. Each life form and ecosystem has its own intrinsic value, apart from any actual or potential usefulness to people. When a species goes extinct, it never returns.

To sustain life as we know it

We, like all species on Earth, are utterly dependent on the planetary environment. Species and ecosystems provide life-sustaining services, such as maintaining adequate oxygen in the atmosphere, removing carbon dioxide from air, filtering and purifying water, pollinating plants, breaking down waste, and transferring nutrients. Most ecosystems that evolved to provide these services can cope with some loss of diversity: for example, when a species becomes extinct, a new species

may step in to take over its role in the ecosystem.

But there are limits to the protection that this flexibility provides. When species that cannot be replaced are lost, the whole assemblage of species may change, and rare species and their genes may disappear. Nor can this flexibility protect ecosystems against excessive modifications to harness their productivity strictly for human purposes. For example, the dustbowl on the prairies in the 1930s resulted in part from the ploughing up of native prairie grasses with massive soil-anchoring roots. Ploughing transformed the prairie grassland ecosystem. The plants and animals that were adapted to periodic drought were displaced. The new ecosystem, based on crops planted by people, provided social and economic benefits in wet years. In dry years, the soil simply blew away. Erosion of valuable topsoil still occurs and is a serious problem.

Furthermore, most Canadians develop a great aesthetic appreciation of nature as it exists and do not want to be deprived of it. Canadians of many backgrounds place spiritual value on animals, plants, and ecosystems. Canadians do not wish to leave a biologically impoverished Earth to their children and grandchildren.

Insurance for the future

Maintaining the full range of the Earth's biodiversity means maintaining the flexi-

bility to respond to unforeseen environmental conditions. For example, many of Canada's native plant species must endure both hot summers and cold winters. These plants may, therefore, have genetic material that could be used to develop agricultural crops that can withstand greater than normal temperature ranges.

Because natural ecosystems have stood the test of time, we can use them as models of sustainability. As long as we conserve them, we can return to them to learn how to refine or reengineer the croplands, managed forests, and industrial fishing areas that we have created, or to find the genes, species, or microecosystems that were left out of the human-designed system because we were ignorant of their importance.




Long-term human health and prosperity

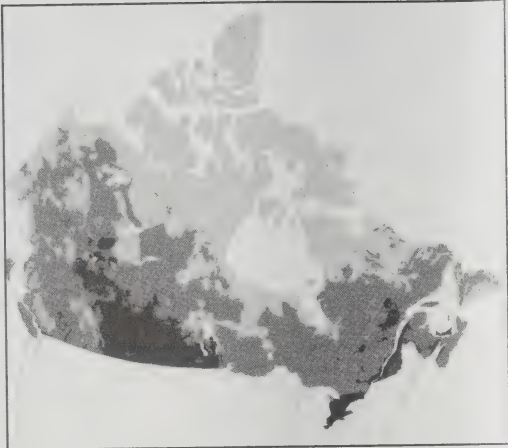
Preserving biodiversity will also maintain our potential as a country to be creative and productive and will provide opportunities for discovering and developing new foods, medicines, and industrial products. Because other species face some of the same biological problems as we do and share the same "genetic alphabet," the biochemical evolution that has been occurring in their populations through millions of generations has produced substances of great usefulness to people. For example, doctors use hirudin, a substance discovered in the saliva of leeches, to dissolve dangerous blood clots. Canada's 138

"If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering."

— A. Leopold. 1966. *A Sand County Almanac*. Oxford University Press. New York. p. 177

Extent to which ecological regions throughout Canada have been changed by human activities

-  Most greatly changed (intensive agriculture, forestry, urbanization, mining)
-  Moderately changed (moderate agriculture, forestry, urbanization, mining)
-  Least changed (recreation, conservation, no human activity)



This map was prepared by the State of the Environment Directorate, based on a system used by Environment Canada to classify Canada's ecosystems. The country's land and ocean ecosystems have been summarized at various levels. The largest category is ecozones; these are subdivided into ecoregions, ecoregions are made up of ecodistricts, and so on.

native tree species have at least 40 recorded pharmaceutical or medical uses, and they are currently used for rayon, cellophane, methyl hydrates, glue, and turpentine.

What is happening to biodiversity?

Global changes

Species go extinct in the normal course of evolution. But the rate of extinctions in the world has greatly increased in recent centuries because of the activities of the huge and growing number of people. The human population now appropriates 20–40% of the solar energy captured by land plants, leaving less for all other species. E.O. Wilson, a world expert on biodiversity, has calculated that, due to the reduction in area of the tropical rain forests alone, making no allowance for overhunting or invasion by alien organisms, today's rate of extinction of species is 1000–10 000 times the rate suggested by the fossil record, which was about one species per million species a year.

Many whales and dolphins are threatened. Roughly 116 of the world's 200 species of apes and monkeys are threatened with extinction. And when larger animals go extinct, so, too, does a universe of microscopic organisms that lived on their bodies and waste materials.

The world's grassland ecosystems have, for the most part, already been converted to crops or pasture. Temperate forests have been logged over and fragmented by

roads, railways, and power corridors, which improve access for wild and domestic predators, people, and invasive species, resulting in disruption of ecological processes. More recently, species-rich tropical rain forest ecosystems have been greatly reduced in area. Wetlands continue to be drained for agriculture and urban expansion. Coral reefs may be in worse condition than either forests or wetlands. Wild lands and waters, and even stringently protected wilderness areas, are vulnerable to oil spills, acid rain, sedimentation, radioactive dust, long-lasting toxic chemicals, and invasive plants and nonnative animals.

Canadian losses

The greatest threat to biodiversity in Canada is the extensive alteration by people of a number of ecological regions, largely because of competing land uses such as agriculture and urbanization. The map shows which areas of Canada people have altered the most. The prairies and southern Ontario have been greatly transformed. Only a few hectares of the tallgrass prairie remain intact, and southern Ontario's Carolinian forest survives only in scattered woodlands. Old-growth forests exist only in patches in the three Maritime provinces, only small stands of old red and white pines remain in central Canada, and the unlogged temperate west coast rain forest keeps shrinking.

In settled parts of Canada, wetlands, which are among the habitats richest in species, have been reduced by as much as 90%,

and drainage, at least on private lands, shows little sign of abatement. Despite legislation to curb acid precipitation, it is predicted that we will continue to lose the fish, shellfish, and amphibian communities of thousands of small lakes in eastern Canada. The Great Lakes ecosystem has been greatly altered by intensive fishing and successive invasions of species, some deliberately introduced to create recreational fisheries, combined with other stresses, such as pollution and alteration of habitat. In Atlantic coastal waters, there has been a considerable reduction of genetic diversity in populations of northern cod, as well as the depletion of stocks of most food fishes.

Most of the species native to these regions at risk still exist in Canada, but their populations have been greatly reduced or fragmented. In some cases, this has already reduced the genetic diversity within species, which gives species the best chance to adapt to future stresses through selection. For example, the 12 or 13 forms of lake trout in Lake Superior have been reduced to only two or three.

Because most Canadian species are widely distributed, we have lost relatively few known species compared with tropical regions. Since about 1750, Canada has lost the Great Auk, Passenger Pigeon, Labrador Duck, Dawson caribou, sea mink, Banff longnose dace, deepwater cisco, longjaw cisco, and blue walleye. We do not know exactly how many more wild species are in danger of a similar fate, because we have not studied all Canadian wildlife.

While these losses have been going on, Canada has also been gaining species. A number of wild species that now form an integral part of our fauna or flora were deliberately introduced, such as the European Starling and several ornamental plants. Others were accidentally imported and in some cases have proved exceedingly difficult and costly to control, such as wild oats, zebra mussels, and the fungus responsible for Dutch elm disease. It is prudent not to create conditions that will result in our own native species being displaced.

What can we do to protect biodiversity?

It is important to prevent further losses. The geological evidence suggests that biodiversity does not recover quickly. Fossils indicate five previous major periods of extinction, the most recent being the extinction of the dinosaurs. After

each previous extinction event it appears to have taken millions of years for life to regain former levels of diversity.

A global effort

The United Nations Convention on Biological Diversity, which Canada played a leading role in developing, provides an opportunity for countries to work in partnership on this complex global issue. It supports those working for sustainable development in all signatory countries.

The convention addresses daunting global challenges: protection of wilderness, management of other areas for diversity, sustainable use of the components of biodiversity, and equity between rich and poor countries in sharing the costs and benefits of conserving the Earth's biological wealth.

How can we conserve biodiversity in Canada?

We must continue to survey our country's flora and fauna to learn what exists and what needs protection.

We can continue to set aside areas where activities disruptive to ecosystems or harmful to wildlife are not allowed (e.g., parks, ecological reserves). The federal, provincial, and territorial governments are committed to protecting areas representative of Canada's terrestrial and marine natural regions and have instituted policies to try to protect and restore critical wildlife habitats.

Canada has a program to identify and rehabilitate species known to be critically endangered. We should continue to regulate hunting, fishing, and logging and to control the use of toxic chemicals. Canadian laws require the planners of large projects, like dams, to assess the likely consequences of their proposed projects on the environment before the final decisions to proceed are made.

We need to determine the scale at which biodiversity should be conserved and carry out broad-scale landscape planning. We can't have a moose in every backyard, or Bald Eagles nesting near every pond.

One of the most crucial and potentially rewarding tasks is the study of wild areas and species. One of the things we must learn is how to extract income from wild lands and waters without damaging them. In Canada, trapping fur-bearing animals, hunting, collecting seaweed, fishing, tapping maple trees for syrup, logging in ecologically sound ways, and gathering

(e.g., wild foods, medicines, craft materials) can all generate incomes from wild lands and waters in a sustainable fashion.

All Canadians have a role to play in maintaining biological diversity at present levels. We do not have to stop fishing, farming, logging, and building cities in order to preserve biodiversity, but we do have to limit these activities or at least do them in ways that are compatible with native ecosystems. This often means reintroducing native species to increase biodiversity on farmland, in forest plantations, in rivers, and even in cities.

In 1995, to meet Canada's obligations under the Convention on Biological Diversity, Canada published the Canadian Biodiversity Strategy, and in 1996, all provinces and territories and the federal government signed a National Statement of Commitment to conserve biodiversity and use biological resources in a sustainable manner. Each jurisdiction is responsible for its own biodiversity conservation plan. Information on current activities is available from:

The Biodiversity Convention Office
Environment Canada
Ottawa, Ontario
K1A 0H3
Phone: (819) 953-4374
bcoweb@ec.gc.ca
<http://www.bco.ec.gc.ca/en/activities>

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Web sites

- www.biodiv.org (Convention on Biological Diversity)
- www.bco.ec.gc.ca (Canada's Biodiversity Convention Office)



The Canadian Wildlife Service

The Canadian Wildlife Service of Environment Canada handles wildlife matters that are the responsibility of the Canadian government. These include protection and management of migratory birds as well as nationally significant wildlife habitat. Other responsibilities are endangered species, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

For more information about the Canadian Wildlife Service and its other publications, please contact:

Publications
Canadian Wildlife Service
Environment Canada
Ottawa, Ontario
K1A 0H3
(819) 997-1095 (phone)
(819) 997-2756 (fax)
cws-scf@ec.gc.ca



The Hinterland Who's Who video clips are on the Internet at http://www.cws-scf.ec.gc.ca/hww-fap/video/index_e.html

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Également disponible en français sous le titre
La biodiversité

Published by authority of the Minister of the Environment
©Minister of Public Works and Government Services Canada, 1995, 2002
Catalogue number CW69-4/92-2002E
ISBN 0-662-31460-3
Text: S.P. Burns and J.A. Keith
Revised by Susan Burns, 2001

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WHO'S WHO

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CANADIAN WILDLIFE SERVICE

Government
Publications



Black bear. Credit Ontario Department of Lands and Forests

The black bear

(Ursus americanus pallas)

The black bear is one of the most familiar wild animals in North America today. To many campers it is both a nuisance and an exciting part of their outdoor experience. Most tourists to our provincial and national parks are disappointed if they fail to catch at least a glimpse of a bear during their visit.

Black bears are members of the family Ursidae, which has representatives throughout most of the Northern Hemisphere and in northern South America. Other members of this family that occur in North America are brown or Kodiak bears, grizzly bears, and polar bears. All of these species are considerably larger than the black bear.

Widely distributed in North America, the black bear occurs across the continent from the east to the west coast and is found as far north as Alaska and as far south as Mexico. It is not found in the extreme northern regions of Canada or in the arid deserts of southwestern United States.

Although occasionally found in a variety of habitats, it prefers heavily wooded areas and dense bushland. Maximum numbers are probably attained in areas of mixed coniferous-deciduous forests. It is estimated that in primitive times 500,000 black bears ranged across the continent. Total numbers presently in North America are not accurately known, but there are probably less than half the primitive number.

Physical characteristics and adaptations

The black bear is a bulky, thickset, massive mammal approximately five feet long. Height at the shoulder of adults varies from three to four feet. It has a moderate-sized head with a rather straight facial profile and a tapered nose with long nostrils. Unlike other animals such as the wolf or bobcat, the lips are free from the gums and thus can be manipulated with amazing dexterity. This adaptation greatly assists the bear when feeding, especially if the food is berries or insects. The ears are rounded and the eyes small. The tail is very short and inconspicuous. Its feet are well furred and plantigrade. This means it walks like a man with the entire bottom portion of the foot touching the ground. Each foot has five recurved claws which are not retractable. These are very strong and are used for digging and tearing out roots, stumps, and old logs when searching for food.

Owing to their compactness, bears often appear much heavier than they really are. Adult males weigh about 300–400 pounds, although exceptionally large animals weighing over 600 pounds have been recorded. Females are somewhat smaller than the males.

The normal colour is black with a brownish muzzle and frequently a white patch below the throat or across the chest. Although black is the most common colour, various colour phases such as brown, dark brown, cinnamon, blue-black, and even white also occur. Albinos are infrequent. These lighter colour phases are more common in the western parts of the range and in the mountains than in the eastern sections. The white phase is most common along the coast of the Pacific northwest, but even there it occurs only infrequently. Any of these colour phases may occur in one litter, but generally



Range of black bear

all cubs in a litter are the same colour.

The eyesight of the black bear is relatively poor, but its senses of hearing and smell are well developed. A startled animal will usually attempt to get downwind from an intruder and make an identification by means of its nose. Under favourable atmospheric conditions carrion, which it scavenges, can be detected at considerable distances, probably up to one mile. Frequently the black bear will stand on its hind legs with its nose in the air and scent the wind for any delectable odours.

Black bears appear awkward as they shuffle along, but can move with amazing speed if necessary. For short distances they have been clocked at speeds up to 35 miles per hour. They are good swimmers and have frequently been observed crossing rivers and small lakes.

Climbing is second nature to a black bear. Young animals readily take to trees when frightened. They climb with a series of quick bounds, grasping the tree with their forepaws and pushing with their hind legs. When descending they travel backwards, frequently dropping from the tree from heights up to 10 to 15 feet. Once on the ground, they quickly disappear into the underbrush, apparently unshaken by the rather abrupt descent.

Although they are rarely heard, the black bear has several distinct calls. These include

a growl of anger, a whining call, and sniffs of many sorts. A female with cubs may warn them of danger with a loud "woof-woof" and call them in with a whining or whimpering sound. A young cub in trouble emits a sound that is similar to the crying of a human baby.

Life history

Black bears are essentially solitary animals except for the close bond that exists between females and cubs, and the pairing which takes place during the mating season. Mating takes place in June or July, and the cubs are born the following January or February while the mother is still in her winter den. Generally, two cubs are born, although there may be only one or as many as four. At birth they are about six to eight inches long and weigh slightly more than half a pound. This is only about one two-hundredths of the mother's weight and is relatively much less than the weight of any other placental mammal at birth. They grow rapidly and are quite active by the time they leave the den with their mother in the spring. At one year they weigh from 40 to 75 pounds and at two years over twice this. Although young bears normally remain with their mother at least one year and sometimes longer, they are capable of fending for themselves when six months old.

Both males and females attain sexual maturity between their third and fourth years. Although male bears continue to grow until their seventh year of life, maximum growth in the female is attained somewhat earlier. Bears may live for 25 or 30 years, but most animals in the wild would be less than 10 years old.

In the autumn when days become shorter and temperatures cooler, bears begin to search for a denning site. A suitable site may be under a tree stump, or an over-turned log, or in a hole in a hillside. Most dens are only large enough to accommodate a bear when it is curled up. Generally, females line their dens with grass, ferns, or leaves while males usually do not. Since females usually den earlier they are able to find more lining material than the males, who frequently wait until the first snowfall before entering a den.

In the northern parts of the continent, black bears den earlier and remain there for a longer period of time than bears in the south. In Alaska, bears remain in their dens

for about six months, commencing in late September or October. In the state of Pennsylvania, bears den for about four months and in the valleys of the state of Washington only about two to three months. In Mexico, bears at the lower elevation may not den at all but remain active throughout the winter.

A denning bear is not truly hibernating, since its body temperature remains almost normal and its rate of metabolism is only slightly reduced. This period of dormancy may be described as a deep sleep since most bears can be aroused if prodded sufficiently. If the weather becomes exceptionally warm some bears may wake up and wander around for short periods during the winter months.

With the coming of spring and warmer weather, bears emerge from their dens and search for food. Their disposition at this time may be rather unfriendly since they are thin and hungry after their long period of inactivity.

Travel and feeding habits

Black bears are capable of travelling great distances – game wardens who have live-trapped bears and removed them 50 miles or more from their home ranges have sometimes been surprised by the bears' return. However, their home ranges are usually quite restricted. During the summer they wander over an area of about six square miles. In spring and autumn their range extends to approximately 15 square miles. Like most animals, they have customary routes of travel which they regularly follow as they move from one area to another. Old-time bear hunters took advantage of this and frequently set their traps along these well-used trails.

The major activity period of black bears is from dusk to dawn. Occasionally they will be seen during daylight hours, especially in the autumn when they eat extensively to build up a good supply of fat to tide them over the period of winter inactivity. Recent live-trapping and tagging studies have shown that bears move greater distances during the autumn than during the summer months.

Black bears are omnivorous and will eat almost anything available. Vegetation forms a large part of their diet, especially in the late summer and autumn when berries and nuts are available. Favourite fruits include blueberries, strawberries, juneberries, elder-

berries, black cherries, and apples. Acorns, hazelnuts, and beechnuts are other preferred foods. Insects such as ants and grasshoppers rate high on the black bear's list of palatables. Anyone who has travelled in black bear country is familiar with logs, old stumps, and stones that have been overturned by a foraging bear.

Fish, small mammals, and occasionally birds also occur on the black bear's menu. Carrion of any sort is highly prized and its attractiveness to a bear increases with its degree of decomposition. Of course a tree containing honey is always a treat. Bears drink frequently and are usually found in the vicinity of water.

Parasites and diseases

Fleas and ticks are external parasites that frequently occur on bears. Common internal parasites are broad tapeworms, hydatid worms, hookworms, and lungworms. Trichinosis, which is caused by a nematode or roundworm, is probably the most important parasite of bears, at least from a public health viewpoint. In settled areas bears may become infected by feeding on raw pork containing encysted larvae. Once ingested these larvae enter the blood stream of the bear and settle in various parts of the body where they develop and mature. They often occur in the diaphragm, or in the muscles along the ribs or chest. Since man can become infected, all bear meat should be cooked carefully before consumption. Freezing will also destroy the larvae. Other wild animals such as coyotes, wolves, and foxes can also become infected, so all uncooked garbage should be either burned immediately or buried deeply. The effects of these parasites on the physical well-being of bears is poorly known. Parasite infestation of most bears that have been examined was usually considered to be too light to affect seriously the health of the bear.

In addition to these parasites, bears sometimes suffer from abscesses that may have developed as a result of old gunshot wounds, wounds from fighting, or infected insect bites. They are usually located in the vicinity of the neck and flanks.

Older bears often suffer from dental disorders such as extreme tooth wear or, less often, complete loss of a tooth. In some instances, teeth, usually the molars, may be

so worn that only the root remains. This condition is frequently accompanied by some signs of inflammation and may be painful to the bear. Undoubtedly, bears with severely worn or diseased teeth would be hampered when feeding.

Joints of the long bones and portions of the skull may also become diseased. These abnormalities may take the form of excessive growth or of erosion of parts of the bone. Old injuries such as gunshot wounds probably cause many of these bone disfigurements. Although these injuries may not be severe enough to cause immediate mortality, they may contribute to a bear's death indirectly since loss of agility or stamina would lessen its chances of survival. It is probable that injuries are partly responsible for limiting black bear populations.

Relationship to man

The attitude of man towards bears has always been one of caution, respect, and, in primitive times, even reverence. Even today, many Indian tribes have special veneration for the bear, and any hunter who kills a bear commands considerable respect in his camp. In the early days of settlement, a bear hunter enjoyed considerable prestige because of the presumed danger of his work. The possession of a bear skin was indicative of a hunter's prowess and bravery. Even in our society a bear skin displayed in a modern home serves as a source of considerable comment.

Black bears are extremely fond of garbage and frequently congregate in areas where refuse is permitted to accumulate. This habit occasionally leads them into close contact with people who enjoy observing the feeding antics of the bears, especially the younger ones. Of course, if the bears demolish some picnicker's lunch, this feeding behaviour is not thought so amusing.

Most bears are extremely shy and retiring and usually avoid direct contact with humans. Incidents of black bears attacking humans have been reported, but these are extremely rare. These attacks were usually made by wounded animals or animals in extremely poor physical condition due to old age or disease.

When watching bears in parks or in the woods it should be remembered that these

are wild animals and they should be treated with caution. They should not be fed. Most bears will hastily retreat if a person approaches too closely, but one should not take any unnecessary chances, as bears, like people, are sometimes unpredictable. They make interesting subjects to observe and photograph but they can be dangerous at close quarters.

Management

Management should be directed towards the maintenance of populations in remote areas for hunting and the limiting of numbers in more settled areas where problems of predation may arise. Once considered an undesirable predator and a nuisance, black bears are rapidly gaining popularity as a prized game animal throughout most sections of North America. A spring bear hunt is especially appealing to the many sportsmen who prefer larger game, since it provides them with the opportunity to hunt big game during the spring when other animals are protected. Inhabiting heavily timbered country, largely nocturnal, shy and elusive, they tax the skill of any hunter who attempts to collect his own bearskin rug. In addition, bear meat if properly prepared is considered highly palatable by many fanciers of wild game.

Occasionally bears cause trouble when they prey on livestock or upset beehives in an apiary. Usually incidents of this type are caused by one or two specific individuals and the problem is solved by their removal.

Undoubtedly the status of black bears as game animals will be enhanced in the future as human populations expand and the demand for huntable game species increases. Because of its value as a tourist attraction and big game species, further investigations into the ways of this wily northwoods wanderer merit our attention.

Reading list

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How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Migratory Birds Convention Act and Regulations for the federal government. In practice, federal and provincial governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's National Parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a pesticide investigator, and a biometrician. The head office is in Ottawa and there are regional offices in Edmonton and Ottawa. Smaller offices are located at Fort Smith and Inuvik, Northwest Territories; Whitehorse, Yukon Territory; Vancouver, British Columbia; Calgary, Alberta; Saskatoon, Saskatchewan; Winnipeg, Manitoba; Aurora, Ontario; Ste-Foy, Quebec; Fredericton and Sackville, New Brunswick; Halifax, Nova Scotia; and St. John's, Newfoundland.

The Service administers 94 migratory bird sanctuaries throughout Canada. It is now participating with the provinces in a major program of preserving, by purchase and long-

term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program was announced on April 6, 1966, that provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province please contact your chief provincial game officer.

Additional notes

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Black Bear



The black bear (*Ursus americanus*) is one of the most familiar wild animals in North America today. To many campers it is both a nuisance and an exciting part of their outdoor experience. Most tourists to our provincial and national parks are disappointed if they fail to catch at least a glimpse of a bear during their visit.

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Widely distributed in North America, the black bear occurs from the east to the west coast and as far north as Alaska and as far south as Mexico. It is not found in the extreme northern regions of Canada or in the arid deserts of southwestern United States.

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Owing to their compactness, bears often appear much heavier than they really are. Adult males weigh about 300 pounds, although exceptionally large animals weighing over 600 pounds have been recorded. Females are somewhat smaller than the males, averaging 150 pounds.

The normal colour is black with a brownish muzzle and frequently a white patch below the throat or across the chest. Although black is the most common colour, other colour phases such as brown, dark brown, cinnamon, blue-black, and even white also occur. Albinos are infrequent. These lighter colour phases are more common in the western parts of the range and in the mountains than in the eastern sections. Any of these colour phases may occur in one litter, but generally all cubs in a litter are the same colour as their mother.

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pairing which takes place during the mating season. Mating takes place in June or early July, and the cubs are usually born the following January or February while the mother is still in her winter den.

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Males and females may attain sexual maturity between their third and fourth years, but often later in the wild. Male bears continue to grow until their seventh year of life: females cease growth somewhat earlier. Bears may live for 25 or 30 years, but most animals in the wild would be less than 10 years old.

In the autumn when days become shorter and temperatures cooler, bears begin to search for a denning site. A suitable site may be under a tree stump or over-turned log, or in a hole in a hillside. Most dens are only large enough to accommodate a bear when it is curled up. Generally, females line their dens with grass, ferns, or leaves while males usually do not. Since females usually den earlier, perhaps they are able to find more lining material than the males, who frequently wait until the first snowfall before entering a den.

Black bears den earlier and remain there for longer in the northern parts of the continent than in the south. Whereas in the Yukon, bears remain in their dens for about six months, beginning in late September or October, in Mexico, bears at lower elevations may not den at all.

A denning bear is not truly hibernating, since its body temperature remains almost normal and its rate of metabolism is only slightly reduced. Most bears can be aroused if prodded sufficiently. If the weather becomes exceptionally warm some bears may wake up and wander around for short periods during the winter months.

With the coming of spring and warmer weather, bears emerge from their dens and search for food. Their disposition at this time may be rather unfriendly since they are thin and hungry after their long period of dormancy.

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Black bears are omnivorous and will eat almost anything available. Vegetation forms a large part of their diet, especially in the late summer and autumn when berries and nuts are available. Favourite fruits include blueberries, strawberries, junberries, elderberries, black cherries, and apples. Acorns, hazelnuts, and beechnuts are other preferred foods. Insects such as ants and grasshoppers rate high, and black bears will overturn logs, old stumps, and stones while foraging.

Fish, small mammals, and occasionally birds are also on the black bear's menu. Carrion of any sort is highly prized and its attractiveness to a bear increases with its degree of decomposition. Of course a tree containing honey is always a treat. Bears drink frequently and are usually found in the vicinity of water.

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Bears sometimes suffer from abscesses, usually in the neck and flanks, that may have developed as a result of old gunshot wounds, wounds from fighting, or infected insect bites.



In addition, old injuries such as gunshot wounds may cause bone disfigurements and may lessen agility or stamina. It is probable that injuries are partly responsible for limiting black bear populations.

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Most bears are extremely shy and retiring and usually avoid direct contact with humans. Incidents of black bears attacking humans have been reported, but these are extremely rare. These attacks were usually made by bears which had been feeding on garbage or animals in extremely poor physical condition due to old age, disease, or wounds.

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CWS studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory and the national parks.

For further information on wildlife in your province, please contact the director of your provincial fish and wildlife department.

Canadian Wildlife
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Black-capped Chickadee



Over a broad band from east to west across Canada, a remarkable small bird, the Black-capped Chickadee (*Parus atricapillus*) has its home. Wherever it goes, in summer and winter, vigour and animation are the mark and seal of this winsome bird.

Appearance

Measuring only five to five-and-a-half inches from bill-tip to tail-tip, the chickadee is grey above with a white underside shading to light brownish buff along its flanks. Its long, dark-grey tail looks like a handle. A black cap, well drawn over sparkling eyes, covers its head from cone-like bill to nape. Pure white cheek patches and a triangular black throat patch complete its most conspicuous markings.

Distribution

The Black-capped Chickadee is found in Newfoundland, as far west as British Columbia (except for the coastal islands and north coast) and extends northwards into the southern areas of the Territories. It lives in tree-covered areas — woodlots and orchards — where it digs its nest-holes in the soft or rotting wood of trees and finds the food it prefers.

The chickadee is ordinarily a year-round resident, but in the northern regions it does occasionally migrate southwards. It is thought that such migration occurs only in years when there is a shortage of food, sometimes combined with an unusually successful breeding season.

Habits

In fall and winter, the chickadee lives in loose flocks of eight or twelve birds. The flock flits from tree to tree, meandering through long-established forest paths at a rate of about a quarter of a mile an hour. It wanders over an area of 20 to 50 acres. The birds keep in touch with each other by means of soft notes, "sit-sit", uttered at intervals.



In the north, the chickadees usually roost in dense evergreen groves sheltered from the wind and snow. At roosting time, some of them disappear into any available hole where they spend the night, one bird to a hole. Others roost in the top branches of evergreens or low down in but young spruces. Night after night, the flock may use the same roosting place.

Feeding

From sunrise to sunset, the chickadee spends most of its time feeding. The bird hops along a branch, clutches an upright trunk, or hangs upside down at the tip of an evergreen twig, examining every crevice and cranny for tiny hidden creatures.

The chickadee eats insect eggs, larvae and pupae (insects in the torpid stage), weevils, lice sawflies and other insects, as well as spiders. It feeds in such large quantities that it is easily one of the most important pest exterminators of the forest or orchard.

When food is plentiful, particularly in the late summer and fall, the chickadee becomes a food hoarder. Leaving the flock, it carefully tucks a morsel away under a buckled piece of bark, or in a patch of lichens — often only to pull the morsel out again and repeat the tucking-away ceremony in another place.

Hoarding food is important to the economy of northern birds. This habit provides a meal for whoever finds the hidden morsel, and also ensures extra supplies along customary feeding routes when food is scarce.

Adaptation

To keep warm, especially in winter, the chickadee has soft, thick feathers which it erects to trap warm air close to its body. This serves as good insulation against the cold.

The chickadee also eats plenty of food which is turned into energy. During the short winter day, rate of feeding is speeded up and food not needed for the immediate activity of moving around and foraging is stored as fat. The fat provides energy that the chickadee needs to survive while sleeping and fasting through the long, cold night. It is easy to see how important are the foods — sunflower seeds, peanuts and ordinary beef or chicken fat — offered at a feeding station in winter.

Voice

The chickadee makes a variety of cheeps and twittering notes. The best known is the "chickadee-dee-dee" that gives the bird its name. By this note, the chickadee challenges or scolds an intruder, or expresses alarm at something that frightens it.

On the coldest bright morning in early January, it often emerges from its roosting place singing. The song is a short ditty of two or three



whistled notes (one higher, accented and prolonged, followed by one or two lower, shorter ones): "phee-ee-bee", or "phee-ee-bee-bee". It may sing at any time of the year, but does so mostly in the early part of the nesting season.

Breeding

February is courtship time. Cheeping loudly, the chickadees spend much time chasing each other. They whirl around a tree in wild pursuit, suddenly stopping as quickly as they started. The flock gradually breaks up into pairs. Each pair travels alone, the female usually in the lead. Although the female looks exactly like the male, she is now easily recognized by her voice, which takes on a peculiarly raspy quality at the beginning of the breeding season.

The male feeds the female often, and she accepts his offerings, crouching and shivering her wings like a baby bird. This ceremony is called courtship-feeding. Wherever she goes, the male defends a small area around her against other chickadees.

By the end of March, the female begins looking for a nesting place. Once it is chosen, the male defends the surrounding area against intruders. This area of 8 to 17 acres forms the pair's territory.

Together, they dig out a hole in the rotting wood of a dead stub, usually about three to ten feet above ground. They may also nest 30 to 40 feet up in the dead parts of live trees, or in hollows abandoned by other hole-nesting birds.

When the hole is made, the female makes a soft nest bed with fine fibres, plant down and hairs. Here she lays one egg a day until there are five to ten, but clutches of six to eight are the most usual. The eggs are white with fine dark spots, and they are so fragile that it is difficult to pick them up without breaking them.

Only the female incubates, or sits on, the eggs for 20- to 30-minute periods during the day, and for the entire night. While she is on the nest, the male feeds her, but she also takes time off to look for food.

At this time, the birds are wary and secretive. Should a would-be nest robber darken her doorway, the female snarls and hisses in protest. The sound is so startling that it may momentarily disconcert an attacker, making escape possible.

After 13 or 14 days, the young hatch. The female broods, or warms, the young until they are well feathered. Both parents clean the nest by carrying away the droppings, and feed the nestlings about 6 to 14 times an hour. A study by Dr. E. P. Odum shows that feeding and looking after six to eight nestlings can so drain the parents' energy reserve that there are times when they survive only with great difficulty.

After 16 or 17 days, the young are ready to leave the nest. They come out clean and fluffy images of their parents. Like most other hole-

nesting birds, they know how to fly by this time, although their ability increases with practice. For two or three weeks more, the parents continue to feed them, while they gradually learn to feed themselves.

By this time, the parents look worn out. They lose their feathers at a fast rate, and it is easy to tell them apart from the younger generation. The new plumage takes six to eight weeks to grow out fully. After that, it is no longer possible to know the young from the old. The family may stay together for a short time, but its members soon disperse to join the autumn flocks that tour the woods, feeding and hoarding.

Social relations

In their social relations, chickadees establish an order of dominance, or "pecking order", by which each bird is known to the other according to rank. A bird's rank is set by its degree of aggressiveness. Thus all the birds in the flock are subordinate to the most aggressive bird; and the lowest ranking is subordinate to all the others. The rest are graded in between. The higher ranking bird fights, chases and threatens the subordinate bird which is always on the defensive and gives way to it.

Enemies

Bird-hunting hawks and the northern shrike (*Lanius excubitor*) are among the chickadees' most dangerous enemies. In addition, weasels, chipmunks and squirrels enter their nests, or tear them open and eat the eggs or young birds.

Other species

The Mountain Chickadee (*Parus gambeli*) is known from the black-capped by a white line over the eye. In Canada, it lives only in the mountains of British Columbia and Alberta. It lays its eggs mostly in natural cavities or in abandoned woodpecker holes.

The Grey-headed Chickadee (*Parus cinctus*) is widely distributed across Asia and Europe. On the North American continent, this brownish-grey chickadee is found in a small corner of north-western Yukon Territory where it lives in the willow and spruce woods bordering the tree line.

The Boreal Chickadee (*Parus hudsonicus*) is also known as the Brown-headed, or Hudsonian, Chickadee. It is a lovely little bird with a seal-brown cap, greyish-brown above and dusky white or light grey below with rust-coloured sides. Its cheek patches are often dusky white and the throat patch is black. Long before you see it, you may hear its rather wheezy call notes. Its song is a musical "pit-tulululu".

Like the black-cap, it lives right across Canada, except in the southern parts of the prairie provinces. It also goes farther north, to parts of Labrador and across Hudson Bay to the Arctic Sea coast in the far northwest. The bird dwells in



the coniferous forests, in swamps and muskeg where trees grow. It nests in holes in stubs and dead trees, and lays its eggs on a bed of compressed fur.

The Chestnut-backed Chickadee (*Parus rufescens*) lives in the coastal forest and southern part of British Columbia. Its brown crown and brownish-black throat match well with its chestnut back and sides. Nesting like the others in stubs, dead trees and holes dug by woodpeckers, it uses hairs, moss and feathers to make its bed.

Relation to man

Not only for the part the chickadee plays in the natural control of insects is it worth our while to encourage and protect it. Our forests would indeed be silent and still were it not for this hardy little fellow that fills them with song and life even in winter.

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Environment Canada
Wildlife Service

Environnement Canada
Service de la Faune

Issued under the authority of the
Honourable Jack Davis, PC, MP
Minister of the Environment
© Information Canada, Ottawa, 1973
Catalogue No. CW 69-4/25
Text: Louise de Kiriline Lawrence
Photo: Hugh M. Halliday
Design: Gottschalk + Ash Ltd.

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Cackling Canada goose (left) and giant Canada goose (right) — the smallest and largest of the races of Canada geese. A white-fronted goose in the rear. Photo by H. C. Hanson

The Canada goose

(Branta canadensis)

The appeal of the Canada goose is legendary. The spectacle of the birds migrating in long, honking, irregular "V" formation across spring or autumn skies is always thrilling. They are one of the most dramatic portents of the change of seasons in Canada.

To the Cree Indians of the Hudson Bay lowlands, who hunted the Canada geese on their way north each April, the arrival of the birds marked the end of winter privation and scarcity, and sometimes even meant relief from starvation. Spring migration brought similar, though less crucial, encouragement to the early Canadian settlers, weary of winter. Today, few species of North American birds

are so widely distributed over the continent, are comprised of so many varieties or races, and provide so much opportunity to explore the mysteries of bird biology.

Varieties and distribution

Although hunters and bird-watchers commonly recognize three sizes of Canada goose – the large “Honker”, the lesser Canada goose, and the Hutchin’s or, in the West, the cackling Canada goose – there are actually 20 “races”, or subspecies, of this wonderful bird.

Most of these races are surprisingly distinctive. For instance, they range in weight from 2½ to 18 pounds, and in wingspread from about 3 to 6½ feet. They vary in colour from a light pearl-grey to a chestnut-brown and even a blackish brown. However, all the races have whitish cheek patches and a black head, crown, and neck. Variations in body proportions, particularly the relative length of the neck, shape of the body, and the body stance, further distinguish the different races. In general, the larger the race the longer the neck and the more elongated the body; the smallest races have very short necks and compact, almost blocky bodies. What is considered the Canada goose by the layman in one region is often a quite different bird from what is considered a typical Honker in another region.

The range of the species extends from the outermost Aleutian Islands east to Newfoundland and the New England states (formerly), and from Kansas and Tennessee in the south, north to southern Victoria Island and southern and southwestern Baffin Island. The southern portions of this range east of the Rockies were once occupied by the giant Canada goose (*Branta canadensis maxima*). It was all but exterminated from the U.S. sector of its range by the early 1920’s. Fortunately, some remnants of this goose, thought to be extinct until 1962, survived. It is now being restored to much of its former range. However, this vast over-all range is actually highly fragmented, each race preferring its own special habitat type. The ranges are separated by well-defined natural barriers – high mountainous country, glaciers, deserts, or heavily wooded and rocky country – all of which are generally unsuitable for nesting geese.



Approximate limits of former and present breeding range of Canada goose

Relation of size to distribution

The distribution and size of these races vary closely with the climate of their breeding grounds. A goose breeding in the far North must complete nesting, rearing of young, and moulting (replacement of flight feathers) in a comparatively short period of time between spring melt and winter freeze-up. Studies have shown that the smaller races of these geese have shorter incubation periods, shorter fledgling periods, and because their flight feathers are shorter they require less time to grow to the flight stage after moult. Consequently, there is a selection for smaller races with shorter breeding and moulting periods as the climate on the breeding area becomes progressively more severe. For example, the giant Canada goose – the race of the Great Plains and the Mississippi Valley – requires 28–30 days for incubation, 70–80 days for rearing of young, and 40 days for the adult moult. The smallest race, the cackling Canada goose (*Branta canadensis minima*) requires only about 25, 42, and 24 days respectively for those stages.

There is a general rule in biology (Bergmann’s rule) that in resident species, because of the necessity to conserve heat, colder

climates select for large races which have a lesser area of body surface relative to body weight than do smaller races. In winter the various races of the migrant Canada geese are distributed in accordance with this rule. The giant Canada goose, the southernmost breeding subspecies, migrates the shortest distance and many populations winter on the central portions of the Great Plains as long as spring-fed streams and food are available. Some populations of the smallest races which nest in the eastern and central Canadian Arctic travel all the way to the southern United States and even northeastern Mexico to spend the winter. Thus, it is principally a *time* factor that selects for the size of the subspecies that nest in the various portions of the breeding range of the Canada goose, and principally a *temperature* factor that determines the distribution of these races or subspecies in winter.

The habits of the Canada goose can be dealt with by describing a subspecies known as the Honker (*Branta canadensis interior*) that nests in the Hudson Bay region and winters in the Mississippi Valley.

Spring migration period

The vast muskeg region of northern Ontario bordering the west coast of James Bay and the south coast of Hudson Bay is the magnet which seems to draw the Honkers northward each spring to nest. These geese reach their breeding grounds in late April, several weeks before the break-up of the major rivers. Their arrival so characterizes this month that it is known to the Cree Indians as "niskapesim" or goose moon. At this time there may still be several feet of snow in the bush.

While waiting for the snow and ice to clear from portions of the interior muskeg where they will nest, the early arriving geese fly back and forth between open spots along the rivers. To feed, they often resort to snow-free areas in the muskeg where they consume sedges and berries remaining from the previous autumn. The Canada's are hardy birds and having put on a layer of fat before migration are easily able to sit out extended periods of severe weather. Even so, spring in the North is often capricious; late blizzards may force the advance flocks to retreat southward several times before they finally reach their breeding grounds.

Breeding habitat

The great muskeg, as their breeding grounds have aptly been called, is a country nearly impassable to humans on foot. It is referred to by geographers as the Hudson Bay lowlands. Largely a waterlogged plain, 125,000 square miles in extent and lying only a few feet above sea level, its surface varies from scattered blocks of stunted spruce and tamarack to large areas of bogs and pothole lakes. Because floating mats of sedges and grasses cover much of the water areas its appearance is often deceptive, and the Cree Indians who hunt and trap the muskeg may suddenly plunge hip deep in cold water.

However, not all of this lonely muskeg land of the North is attractive to pairs of nesting geese. Extensive bogs and large lakes in themselves usually do not constitute ideal nesting habitat; rather it is the patches of closely lying pothole lakes which have one or more small islands that appear to be the most attractive to nesting geese. In choosing such lakes, the mated pairs could not seek out more beautiful country for their summer sojourn.

Nest sites are frequently located on islands or islets, often close to woody vegetation and usually within a few feet of water. However, in some areas nests may be located out on waterlogged sedge—grass muskeg plains at considerable distance from any sizable pond or lake. Usually five to seven eggs are laid, with older birds producing larger clutches than birds nesting for the first time.

Although the factors which affect success of the nesting season have yet to be fully determined, weather conditions are undoubtedly very important. In some years the relative number of pairs that produce young may be as little as one-third that found in other years. However, because geese do not breed until two years of age, alternate annual variations in the age structure of a population are a normal phenomenon. For example, a bumper crop of young one year is certain to lower the percentage of geese of breeding age in the population the following year; conversely, two years later the addition of these geese to the breeding segment of the population results in another large crop of young which again reduces the percentage of geese of breeding age in the wintering population.

Canada geese are potentially long-lived,

particularly the giant Canada goose for which there are numerous records of captive individuals living to 40 and occasionally 60 years. However, in the wild, the average age – due in part to heavy hunting – is usually less than two or three years, although there are several instances of banded geese (*B. c. interior*) attaining at least 22 years.

Behaviour

Like most birds, the Canada goose is a curious mixture of sociability and intolerance of others of its kind. In breeding areas where the habitat is limited and nesting islands are scarce, as in some sections of the West, Canada geese will nest in close proximity. In the North, where lakes with islands are numerous, each pair will reserve a lake to itself, or in the case of the larger lakes, a bay or comparable section. Some may nest in boggy areas at a considerable distance from water, but most pairs are well separated from each other.

While the female undertakes the chore of incubating the eggs, the male stands guard somewhere in the vicinity. In the muskeg of northern Ontario, the male is usually seen several hundred yards from the nest. After a 28-day period, during which time the female leaves the nest only briefly each day to feed, the eggs are hatched.

Soon after the young have hatched, the families seem to obey an urge to leave the nesting area. The adults are flightless at this time, of course, because they are moulting and growing new primary feathers on their wings. Those in the far interior of the muskeg, which constitute the bulk of the Mississippi Valley Flyway population, wander from lake to lake, feeding on grasses and sedges as they cross the intervening stretches of floating sedge mats. If the geese have nested near the sea coast, they often descend the rivers to more favourable coastal marsh and tundra feeding areas. When rapids are encountered, the birds travel overland to the next stretch of calm water.

A pair with their young of the year is an inseparable troupe, acting in unison almost as a single biological unit. In moving about, the female leads the way, followed by the young, with the gander bringing up the rear. When another goose family ventures too close and appears to be competing for the same feed-

ing area, "battle formation" is assumed, the male acting as the head of a V-like phalanx, ready to do physical battle while the female and young assume threatening postures behind him. The gander literally defends the ground he and his family walk on, plus a few square feet of surrounding area. A fancied infringement of such indefinite moving territories by other geese may be the cause for a battle royal between the ganders of the two families. Curiously enough, the victor of such encounters can be predicted with such statistical assurance that if money were wagered, the observer "in the know" would be sure of a profit. In encounters between the ganders of two families, the psychology of strength in numbers seems to be the decisive factor – not the apparent size or weight of the antagonists. Thus male geese with large families almost always defeat males with small families, whether the ganders actually fight or merely threaten each other.

Late summer and autumn migration period

During this period of wandering, the young goslings grow their flight feathers, while the adults moult and regrow theirs. The family remains grounded until early August when the birds are ready to take to the air as a family unit. Some families remain inland, while others fly to the shores of Hudson and James Bays where they feed on berries and put on a layer of fat prior to their southward migration. There they are joined by tens of thousands of blue and snow geese that have nested in the Arctic.

Some of the Canada geese linger on the shores of Hudson and James Bays until early October and then suddenly in the space of a few days they are gone. Those that have flocked along James Bay follow the coastline south. The inland geese tend to follow the north- and south-trending rivers. A few days' flight returns them to their autumn and winter quarters in the United States, which in most cases are federal, state, and private refuges.

Research and management

Banding is one of the important tools of waterfowl research. From the reports of hunters who have shot banded waterfowl, it has been learned that the migrations of geese, unlike those of ducks, follow restricted systems of flyways or routes of migration which return

them to the same wintering and breeding grounds each year. From the standpoint of management, this means that should a flyway population of geese be severely depleted – and this could be a subspecies dangerously limited in size – an influx of birds from other areas cannot be depended upon for rebuilding its numbers.

The Canada goose populations which nest more or less continuously inland from the coasts of Hudson and James Bays, from Churchill in the northwest to the Ungava Peninsula at the northeast end of Hudson Bay, typify the adherence of geese to their ancestral flyways. Band recoveries from members of this extensive population reveal that they belong to four different flyway populations.

The geese of the South Atlantic Flyway nest inland from the east coast of Hudson Bay. They fly southeastward from the end of James Bay and winter on Chesapeake Bay and the coastal areas of Virginia and North Carolina.

The geese of the Southeast Flyway nest around the east and south sides of James Bay and on Akimiski and Charlton Islands. They winter inland along the rivers and reservoirs of South Carolina, Tennessee, Georgia, and Alabama.

The Canada geese of the Mississippi Flyway nest in the muskeg south of Hudson Bay and west of James Bay. This population winters close to the Mississippi River, chiefly near the southern tip of Illinois, even though prior to the development of the waterfowl refuges in southern Illinois they did not winter farther south than Memphis, Tennessee.

The geese of the Eastern Prairie Flyway nest in northeastern Manitoba south of Churchill and migrate chiefly through Minnesota and Iowa to winter in central Missouri and southward to the coast of the Gulf of Mexico.

Research and management are paying substantial dividends in the restoration of Canada goose populations that have been depleted by excessive hunting. Research is showing the biological basis on which Canada geese must be managed. Management, by annual assessment of the production of young, a quota system limiting kills in the flyway, post-season population inventories, and long-term programs of refuge acquisition

and development, is assuring the future of these birds. From an all-time population low of 22,000 in 1946, the Canada goose population in the Mississippi Valley Flyway has reached about 300,000. The total continental population of all races of Canada geese may, in some years, be as high as a million birds.

For those who have followed and participated in this conservation program, perhaps one of the most rewarding aspects of the experience has been in the smiles of Cree Indians when they report that “there are more than ever”.

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How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of

migratory birds. The Canadian Wildlife Service administers the Migratory Birds Convention Act and Regulations for the federal government. In practice, federal and provincial governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's National Parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a pesticide investigator, and a biometrician. The head office is in Ottawa and there are regional offices in Edmonton and Ottawa. Smaller offices are located at Fort Smith and Inuvik, Northwest Territories; Whitehorse, Yukon Territory; Vancouver, British Columbia; Calgary, Alberta; Saskatoon, Saskatchewan; Winnipeg, Manitoba; Aurora, Ontario; Ste-Foy, Quebec; Fredericton and Sackville, New Brunswick; Halifax, Nova Scotia; and St. John's, Newfoundland.

The Service administers 94 migratory bird sanctuaries throughout Canada. It is now participating with the provinces in a major program of preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program was announced on April 6, 1966, that provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province please contact your chief provincial game officer.

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Barren-ground caribou. Photo by Don Thomas

The caribou

(*Rangifer tarandus*)

Although caribou are one of the most widely distributed of Canada's large mammals, most Canadians know them only as the animal on a 25-cent piece. Caribou are well known to most northern Canadians, and to Newfoundlanders. To many northerners they are an essential economic resource.

Caribou are found in Canada from close to the U.S. - Canada boundary in Ontario and British Columbia, to northern Ellesmere Island more than 2,400 miles north. Their approximate range is shown on the accompanying map. Some caribou are forest- and mountain-dwellers; others inhabit the sparse timber and tundra of the far North.

Caribou are wild reindeer, similar to the wild and domesticated reindeer of Eurasia. Although there is only one species of reindeer in the world, two distinct types occur in Canada: the woodland caribou and the tundra caribou.

There are also some Siberian reindeer in the Reindeer Preserve in the Mackenzie Delta

area. They were brought from Siberia to Alaska at the turn of the century. Between 1929 and 1935 several thousand were herded from Alaska to the Mackenzie Delta in an attempt to begin a reindeer industry in the North.

The caribou's relatives include four species of deer native to Canada: moose, elk, white-tailed deer, and mule deer. All are ungulates – cloven-hoofed cud-chewers. However, only in the caribou do both males and females (though not all) carry antlers.

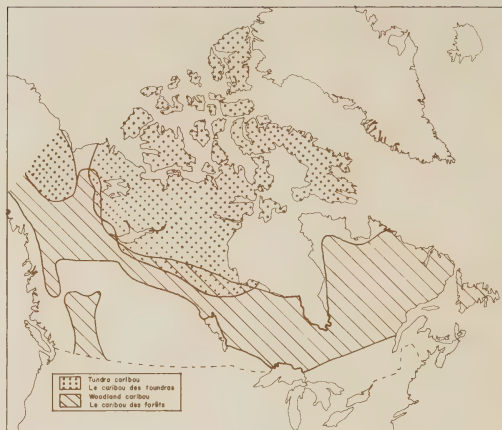
The woodland caribou

A creature of the forests, the woodland caribou usually seeks the seclusion of mature spruce and other coniferous forests, or remote alpine meadows. Woodland caribou are not great travellers. Whereas herds of barren-ground caribou sometimes travel 650 miles or more between winter and summer range, woodland caribou may travel only a few miles from summer range of alpine tundra to winter range in timber lower on a mountain side. Or, in more level areas of the boreal (or northern coniferous) forest, they may graze and browse limited areas of bogs, low-lying grassy areas, or lichen-rich glades, and move perhaps only a few miles to a winter area where tree and ground lichens are available.

Woodland caribou are large animals with long legs. Among adults, males may weigh 500 pounds, although the average weight is about 100 pounds less, and females average about 300 pounds per animal.

The pelage is generally a dark chocolate brown, with limited white areas on the belly, rump and lower legs, and larger white areas on the neck. A woodland caribou bull in full autumn pelage is an imposing animal with its rich colouring, dewlap fringe of white fur flowing from throat to chest, and great rack of mahogany-coloured antlers. The female is somewhat smaller and lighter coloured. All the males and most of the females bear antlers. The antlers of the adult bulls are generally shed shortly after the rut in early December, but females and young animals carry theirs much longer, often through the winter. During their growth, antlers have a dark brown covering called velvet. This covering contains blood vessels which carry the nutrients to the bone.

Large, concave hoofs splay widely to sup-



port the animal in snow or muskeg, and function as efficient scoops as the caribou paws through snow sometimes two or three feet deep to uncover lichens. An area in which caribou have wintered will be pitted with numerous "feeding craters" which the caribou have dug while searching for food. The caribou's Micmac Indian name was "xalibu" – meaning "the one who paws" – and the present name is probably a corruption of this word.

Unlike their tundra cousins, the woodland species do not form huge herds, but they are gregarious, seldom travelling alone. Like all Canadian deer they are polygamous and during the mating season, which begins in September, a bull may collect a harem of several cows. The calving season is in late May, and twins occur often.

Woodland caribou are not as plentiful as they were in earlier times. For instance, the population on the island of Newfoundland – 5,000 to 6,000 animals – is only a tiny fraction of what it was estimated to be 50 years ago. Once abundant, caribou are gone entirely from Nova Scotia, New Brunswick, and other areas of their former range. Over-hunting occurred in some areas in the past, and in others changes in habitat are responsible for the decline in numbers. Much land has been cleared for agriculture, destroying habitat not only for caribou but also for many other animals. Vast areas of forest have been logged

or burned, and replaced by new growth which is much more suitable for moose and deer. Although caribou eat grasses and sedges their primary food is lichens – the so-called caribou moss – which may require 50 to 120 years to mature to the point of usefulness to caribou.

Recently, numbers of woodland caribou have increased, partly as a result of forest-fire protection and partly as a result of closed or strictly limited hunting seasons. As a result, in much of the boreal forest hunting woodland caribou is now permitted. The total number of woodland caribou in Canada today has been estimated to be approximately 43,000 animals.

The caribou of the tundra

There are three subspecies of Canadian caribou which live in the far North and spend much, or all, of the year on the tundra. In the northwest, in the northern mountains of the Mackenzie District and of the Yukon, and extending into Alaska, is Grant's caribou. On the islands of the far North is the small Peary's caribou, numbering only about 25,000. On the Canadian mainland between Mackenzie River in the west and Hudson Bay in the east, on Baffin Island, and on some of the islands in Hudson Bay is found the barren-ground caribou.

Both Grant's caribou and the barren-ground caribou of the mainland tend to spend their winters in the northern forest. This forest is largely coniferous and contains areas of black and white spruce, tamarack, poplar, and birch, interspersed with open areas of bog, muskeg, and lichen-covered rock. In some areas toward the southern portions of the caribou range the trees are large, but towards the north they grow increasingly smaller, until, on tree line, a spruce 300 years old may be less than 10 feet tall. Tree line on the tundra edge, unlike on mountains of more southerly latitudes, is not a sharp line of demarcation; rather the areas of stunted trees grow fewer and the areas of low shrubs and grass-like plants become abundant until finally there are no more trees at all.

In general barren-ground and Grant's caribou spend their winters in the forest and their summers on the tundra. Peary's caribou, living on high arctic islands, are on tundra the year round.

Physically, the barren-ground caribou is well adapted to its environment. It has a short, stocky body, and its winter coat is long and dense, providing effective insulation even during periods of low temperature and high wind. The muzzle and tail are short and well-furred. Hoofs are broad and sharp-edged. Thus they provide excellent support in snow or muskeg, give firm footing on ice or smooth rock, are effective in clearing snow from lichen patches, and function well as paddles when the caribou swims. Caribou are the best swimmers of the entire deer family.

Barren-ground caribou are clove-brown in colour with a prominent white neck. Parts of the flank and rump, belly, muzzle, and socks are also white. Barren-ground caribou are generally smaller than woodland caribou, with adult bulls averaging 238 pounds, and adult cows averaging 171 pounds. Grant's caribou are considerably larger, and Peary's caribou much smaller.

Antlers of barren-ground caribou tend to be longer, rangier, and the main beams more rounded than those of woodland caribou. Antlers of adult bulls are shed in the autumn after the rut while those of the cows and younger animals are carried through winter and shed in spring.

Caribou have an excellent sense of smell, which they use to locate lichens under the snow. Their hearing is also good, but their poor eyesight, plus their unwary nature, makes them easy to deceive. Caribou are very curious and biologists have found that slowly waving their arms, or bobbing up and down from the waist, will often attract caribou to close range.

Annual cycle

There is a fixed annual pattern in the life of a barren-ground caribou. Most spend winter deep in the northern coniferous forest. A few always, and a great many sometimes, spend the winter on the tundra. Usually the bulls will venture farthest south into the forest where snow tends to be deepest, and the females and yearlings remain nearer tree line where snow is shallower. In March the herds gather to begin the migration to the calving grounds and to their summer range on the barrens.

Caribou are good navigators, unerringly walking hundreds of miles in spring to their

relatively small calving areas. They tend to follow frozen lakes and rivers, open snow-free uplands, and eskers – long narrow hills of soil and rock dumped by glaciers – to their destination. Caribou are able to keep a steady direction across frozen lakes so large that the opposite side cannot be seen. A man cannot do this without a compass.

The pregnant cows lead the spring migration, followed by the yearlings and the bulls which tend to lag farther and farther behind. Most barren-ground caribou cows head toward one of four traditional calving grounds to which they return year after year, even from different wintering areas. Surprisingly, the calving grounds are not in the valleys, where the snow has melted and plants are beginning to grow, but on rugged, inhospitable uplands, still swept by spring storms. Most of the calves are born within the space of about a week, and in some years, if there is bad weather, cold wind and rain or snow may cause the death of many of the new calves.

The calves are precocious, and are able to graze and travel within a few days. The cows and calves soon move to lower elevations where fresh-growing feed is becoming abundant. Here they are harassed by hordes of mosquitoes, warble flies, nose bot flies, and in some areas black flies. Sometimes the animals will run in a frenzy for miles, stopping to rest only when exhausted or when high winds temporarily disperse the insects. During this time the caribou grow thin. Only in August, when cooler nights kill the insects, do the caribou begin to gain weight. At this time the herds start a leisurely movement toward the forest.

By late September the herds – fat and in good condition – are arriving at, and moving along, the tree line. The mating season occurs in late October and early November, and it usually takes place along the tree line. Bulls spar a great deal and sometimes fight for possession of females, but seldom build harems.

So well established are the migration routes that each year Indian and Eskimo hunters lie in wait for caribou at places where they cross lakes or rivers. Occasionally, caribou will join another herd and travel to a different calving ground. When this happened in the past, sometimes the hunters and their families starved.

Enemies

A natural predator of the caribou is the wolf. Wolf packs follow the migrating herds from summer to winter range and back. The only time caribou are relatively free of this predator is during calving time, when most wolves remain in the river valleys while the females whelp. It has been estimated that a wolf requires food equivalent to, and may kill, 11 to 14 caribou a year. Most wolves do not live solely on caribou, but also hunt mice, lemmings, other small mammals, and birds. Wolves cannot run as fast as caribou, especially in deep snow, and usually must depend on a stratagem to catch their prey. They may chase a caribou in relays, or may wait in ambush for an unwary caribou.

In the main, wolves kill the aged and injured, or young, weak calves. Most biologists agree that the relationship between wolf and caribou is beneficial to both. Certainly the relationship has evolved and lasted over many tens of thousands of years. It would not be possible for wolves to exterminate caribou – the wolves would starve and disappear first, as indeed has happened on at least one arctic island.

However, the greatest of all predators on the caribou is man. Many Canadian Indians and Eskimos built their culture on the caribou, and could not have survived in the North without them. Some tribes were nomadic, and followed the herds year round; others lived on caribou for part of the year. Caribou provided food, clothing, shelter: bones were made into needles and utensils; antlers were made into tools and the sinew into thread; the fat provided fuel and light; the skin was made into light, warm clothing and tent material; and the flesh fed man and dogs.

Management

With primitive weapons, the take by these hunters was in balance with the numbers of caribou. However, once the rifle was introduced by trappers and traders, it was possible to kill large numbers. Coastal Eskimos were able to travel long distances inland to trap for furs, feeding caribou to the dogs that pulled their sleds.

Dependent on natural forces which they could not control, the Indians and Eskimos tended to have a fatalistic attitude which did not concern itself with tomorrow. When cari-

bou were plentiful, they tended to kill more than were needed or could be used. It has not been easy to teach wise use. It is thought that in the three decades before 1950, kill by humans ranged from 100,000 to 200,000 a year. In some years, this was more than the animals' natural increase.

Originally there were probably no more than two to three million barren-ground caribou. Their numbers began to decline as soon as white men arrived in the North. By 1949, when aerial survey methods made it possible to count caribou for the first time, there were an estimated 668,000 animals. In spite of attempts by federal, territorial, and provincial governments to reduce over-hunting by supervising hunts and enforcing game regulations, and in spite of an emergency wolf-control program, the population continued to fall, to an estimated 278,900 by 1955. For a time there was fear that the caribou might, like the plains bison, approach extinction.

However, a range-wide survey by biologists of the Canadian Wildlife Service in 1967 showed that the decline had stopped. Caribou now number about 357,000. With fewer caribou available, fewer are shot. Also, caribou in recent years have tended to winter remote from major population centres where they would be accessible to hunters. Moreover, it is believed most recent calf crops have been good ones.

Because they eat lichens, which are a major ground cover in the North, caribou can do well in country that will not support similar numbers of other large mammals. Although the North possesses other natural resources, many of them, such as minerals or oil, are non-renewable – that is, once used, they are gone. Properly managed, caribou can be a continuous economic resource in the North.

In the past, exploration and settlement of the North were possible because caribou provided food. Today the caribou can still contribute to the economy of the North. It is expensive to transport food into the North, and caribou are an economical source of meat.

Also, through sport hunting and enjoyment of the animals by naturalists and photographers, caribou could contribute to a tourist industry in the North. The vast herds of migrating caribou present a spectacle unequalled on this continent.

For some native people, in a difficult stage of transition between their traditional way of life and that of the modern world, caribou hunting means the difference between independence and subsistence on government assistance. Wisely used, the caribou can continue to benefit the North.

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How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Migratory Birds Convention Act and Regulations for the federal government. In practice, federal and provincial governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory,

and Canada's National Parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a pesticide investigator, and a biometrician. The head office is in Ottawa and there are regional offices in Edmonton and Ottawa. Smaller offices are located at Fort Smith and Inuvik, Northwest Territories; Whitehorse, Yukon Territory; Vancouver, British Columbia; Calgary, Alberta; Saskatoon, Saskatchewan; Winnipeg, Manitoba; Aurora, Ontario; Ste-Foy, Quebec; Fredericton and Sackville, New Brunswick; Halifax, Nova Scotia; and St. John's, Newfoundland.

The Service administers 94 migratory bird sanctuaries throughout Canada. It is now participating with the provinces in a major program of preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program was announced on April 6, 1966, that provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province please contact your chief provincial game officer.

Additional notes

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**Canadian Wildlife
Service**

Hinterland Who's Who

Government
Publications

Caribou



Although the caribou (*Rangifer tarandus*) is one of Canada's most widely distributed large mammals, most Canadians know it only as the animal on a 25-cent piece. Caribou are best known to most northern Canadians, and to Newfoundlanders. To many northerners they are an essential economic resource.

Caribou are found in Canada from close to the U.S.-Canada boundary in western Ontario and British Columbia, to northern Ellesmere Island more than 2,400 miles north. Their approximate range is shown on the accompanying map. Some Caribou are forest- and mountain-dwellers; some inhabit the sparse timber and tundra of the far north; others remain on the tundra all year.

Caribou are similar to, and belong to the same species as, the wild and domesticated reindeer of Eurasia. Two groups occur in Canada: the woodland and the tundra caribou. There are also some Siberian reindeer on the Reindeer Preserve in the Mackenzie Delta area. Their ancestors were brought from Siberia to Alaska at the turn of the century. Between 1929 and 1935 several thousand were herded from Alaska to the Mackenzie Delta in an attempt to begin a reindeer industry in the Canadian north.

The caribou belongs to the deer family, Cervidae, which includes four species of deer native to Canada: moose, elk, white-tailed deer and mule deer. All are ungulates — cloven-hoofed cud-chewers. However, only in the caribou do both males and most females carry antlers.

The woodland caribou

A creature of the forests, the woodland caribou (*Rangifer tarandus caribou*) usually seeks the seclusion of mature spruce and other coniferous forests, or remote alpine meadows. They are not great travellers. Whereas herds of barren-ground caribou sometimes travel 650 miles or more between winter and summer range, woodland caribou may travel only a few miles from summer range of alpine tundra to winter range in timber

lower on a mountain side. Or, in more level areas of the boreal (or northern coniferous) forest, they may graze and browse limited areas of bog, low-lying grassy areas, or lichen-rich glades, and move perhaps only a few miles to a winter area where tree and ground lichens are available.

Occasionally, deeper than normal winter snow may force them farther north to seek lichens on open windblown areas, particularly along eskers.





Woodland caribou are large animals with long legs. Adult males may weigh 500 pounds, although the average weight is about 400 pounds, and females about 300 pounds.

The pelage is generally a dark chocolate brown with limited white areas on the belly, rump and lower legs, and larger white areas on the neck. A woodland caribou bull in full autumn pelage is an imposing animal with its rich colouring, dewlap fringe of white hair flowing from throat to chest, and great rack of amber coloured antlers. The female is somewhat smaller and lighter coloured. Adult bulls generally shed their antlers in November or December after the breeding season, but females and young animals carry theirs much longer, often through the winter. The growing antlers have a dark brown covering called velvet, which contains blood vessels carrying nutrients for growth.

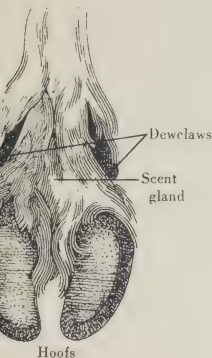
Large, concave hoofs splay widely to support the animal in snow or muskeg, and function as efficient scoops when the caribou paws through snow, often two or three feet deep, to uncover lichens. An area where caribou have wintered will be pitted with numerous "feeding craters" dug by the animal while searching for food. The caribou's Micmac Indian name was "xalibu" — meaning "the one who paws" — and the present name is probably a corruption of this word.

Unlike their tundra cousins, the woodland species do not form huge herds, but they are gregarious, seldom travelling alone. Like all Canadian deer they are polygamous and during the mating season, which begins in September, a bull may collect a harem of 20 or more cows. The calving season is in late May and early June.

Woodland caribou are not as plentiful as they were. For instance, the population on the island of Newfoundland — now about 10,000 — is only a fraction of the number estimated 50 years ago. Once abundant, caribou are gone entirely from Nova Scotia, New Brunswick and some other areas of their former range. They have been reintroduced to Cape Breton. Past over-hunting in some areas and changes in habitat in others brought about the decline in numbers. Clearing of land for agriculture has destroyed habitat for caribou. Vast areas of forest have been logged, burned, and replaced by new growth much more suitable for moose and deer than for caribou. Although caribou eat grasses and sedges their primary food is lichens which require many years to mature to the point of usefulness to caribou.

-  Grant's caribou
-  Woodland caribou
-  Barren-ground caribou
-  Peary caribou





Prevention of forest fires and closed or strictly limited hunting seasons brought about a recent increase in woodland caribou, and hunting these animals is now permitted over most of their range.

The caribou of the tundra

Three subspecies of Canadian caribou live in the far north and spend much or all of the year on the tundra. In the northwest, in the northern mountains of the Mackenzie District and of the Yukon, and extending into Alaska, is Grant's caribou (*Rangifer tarandus granti*). They number hundreds of thousands. On the islands of the far north is the small Peary caribou (*Rangifer tarandus pearyi*) numbering only about 25,000. On the Canadian mainland between Mackenzie River in the west and Hudson Bay in the east, on Baffin Island, and on some of the islands in Hudson Bay is found the barren-ground caribou (*Rangifer tarandus groenlandicus*).

Most of the mainland tundra caribou spend their winters in the northern forest. This forest is largely coniferous and contains areas of black and white spruce, tamarack, poplar and birch, interspersed with open areas of bog and muskeg. The trees, which are large in some areas towards the southern portions of the caribou range, grow increasingly smaller towards the north. On tree line, a spruce 300 years old may be less than 10 feet tall. The trees grow fewer and the areas of low shrubs and grass-like plants become abundant until finally the trees disappear.

In general, barren-ground and Grant's caribou spend their winters in the forest and their summers on the tundra. Peary caribou remain on tundra the year round.

The barren-ground caribou is well adapted to its environment. It has a short, stocky body, and a long dense winter coat which provides effective insulation, even during periods of low temperature and high wind. The muzzle and tail are short and well-furred. Hoofs are broad and sharp-edged. They provide excellent support in snow or muskeg, give firm footing on ice or smooth rock, and are effective in clearing snow from lichen patches. Caribou are excellent swimmers and their hoofs function well as paddles. In summer, the hoofs, worn away by travel and hard rocks, resemble those of a deer.

Barren-ground caribou are clove-brown in colour with a prominent white neck. Parts of the flank and rump, belly and muzzle are also white. Barren-ground caribou are generally smaller than woodland caribou, with prime adult bulls averaging 320 pounds, and adult cows averaging 200 pounds. Grant's caribou are usually larger, and Peary caribou smaller. Antlers of barren-ground caribou are longer and rangier, and the main beams more rounded than those of woodland caribou.

Tundra caribou have an excellent sense of smell, which they use to locate lichens under the

snow. Their hearing is good, but their comparatively poor eyesight and unwary nature make them easy to deceive. Caribou are very curious and hunters have found that slowly waving their arms, or bobbing up and down from the waist, will often attract caribou to close range.

Annual cycle of tundra caribou

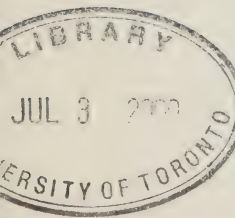
The life of a barren-ground caribou has a fixed annual pattern. Most spend winter in the northern boreal forest. A few always, and a great many sometimes, winter on the tundra. Usually the bulls venture farthest south into the forest where snow tends to be deepest, and the cows and juveniles remain nearer tree line where snow is shallower. The herds gather in spring for the migration to the calving grounds and to their summer range on the barrens.

Tundra caribou are good navigators, unerringly walking hundreds of miles in spring to their relatively small calving areas. They tend to follow frozen lakes and rivers, open snow-free uplands, and eskers — long narrow hills of soil and rock dumped by glaciers — to their destination. Caribou are able to keep a steady direction across frozen lakes so large that the opposite side cannot be seen.

The pregnant cows lead the spring migration, followed by the juveniles and the bulls which tend to lag farther and farther behind. Most barren-ground caribou cows head toward one of four traditional calving grounds to which they return year after year, even from different wintering areas. The calving grounds are usually on rugged, inhospitable uplands, still swept by spring storms. About 90 per cent of the cows produce calves annually. Most of the calves are born within about one week and, in years of bad weather, cold, wind and rain or snow kill many.

The calves are well developed at birth and are able to travel within a few hours. They start to graze during their first few weeks although at this stage they can digest only milk. The cows and calves soon move to areas where fresh-growing feed is becoming abundant. During early summer they are often harassed by hordes of mosquitoes, warble flies, nose bot flies and, in some areas, black flies. Sometimes the agitated animals will run for miles, stopping to rest only when exhausted or when high winds temporarily disperse the insects. Running from insects places greater energy demands on the caribou and temporarily reduces their foraging. This might retard their rate of growth.

In July the herds start to move towards the forest, and by late September the herds — fat and in good condition — are arriving at, and moving along, the tree line. The mating season occurs in late October and early November, and usually takes place along the tree line. Bulls spar a great deal and sometimes fight for possession of females, but seldom collect harems.





Male



Female

The migration routes have always been so well established that, in past years, Indian and Eskimo hunters lay in wait for caribou at places where they would cross lakes or rivers. Occasionally, however, the caribou did change their migration routes, and hunters and their families located near the traditional migration path faced starvation.

Enemies

The wolf is a natural predator of the caribou. Wolf packs follow the migrating herds from summer to winter range and back. Caribou are relatively free of this predator only during calving time, when the breeding wolves are raising their young in areas off the calving ground. A wolf requires food equivalent to, and may kill, 11 to 14 caribou a year. Most wolves do not live solely on caribou, but also hunt mice, lemmings, other small mammals and birds. Wolves cannot run as fast as caribou, especially in deep snow, and must usually depend on a stratagem to catch their prey. They may chase a caribou in relays, or may wait in ambush for an unwary victim.

Wolves have a culling effect on the caribou population, as they kill the aged, or injured, or young, weak animals when they are available. Most biologists agree that the relationship between wolf and caribou benefits both. Certainly the relationship has evolved and lasted over many tens of thousands of years.

However, man is the greatest of all caribou predators. Many Canadian Indians and Eskimos based their culture on the caribou, and could not have survived in the north without them. Some tribes were nomadic, and followed the herds year round; others lived on caribou for part of the year. Caribou provided food, clothing and shelter: bones were made into needles and utensils, antlers into tools and the sinew into thread; the fat provided fuel and light; the skin was made into light, warm clothing and tent material; and the flesh fed man and dogs.

Management

The take by hunters using primitive weapons was in balance with the numbers of caribou. But the introduction of the rifle by trappers and traders made it possible to kill large numbers. Coastal Eskimos were able to travel long distances inland to trap for furs, feeding caribou to the dogs that pulled their sleds. It is thought that in the three decades before 1950, kill by humans ranged from 100,000 to 200,000 a year. In some years, this was more than the animals' natural increase.

Originally there were probably two to three million barren-ground caribou. Their numbers began to decline as soon as white men arrived in the north with their rifles and their demands for furs. By 1949, when aerial survey methods made it possible to count caribou for the first time, there were an estimated 668,000 animals. Despite federal, territorial and provincial government

attempts to reduce over-hunting by supervising hunts and enforcing game regulations, and in spite of an emergency wolf-control program, the population continued to fall, to an estimated 278,900 by 1955. For a time there was fear that the caribou might, like the plains bison, approach extinction. However, a 1967 range-wide survey by CWS biologists showed that the decline has stopped. Barren-ground caribou now number about half a million.

Exploration and settlement of the north were possible because caribou provided food. Today caribou are still an economical source of meat, for transporting food into the north is expensive. The vast herds of migrating caribou present a wildlife spectacle unequalled on this continent and, as an attraction to naturalists, photographers and sport hunters, could contribute to a tourist industry in the north.

For some native people, in a difficult stage of transition between their traditional way of life and that of the modern world, caribou hunting means the difference between independence and subsistence on government assistance.

Because they eat lichens, a major ground cover in the north, caribou can do well in areas that will not support similar numbers of other large mammals. Wisely used, caribou can be a continuous economic resource in the north.

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Environment Canada
Wildlife Service

Environnement Canada
Service de la Faune

Issued under the authority of the
Honourable Jack Davis, PC, MP
Minister of the Environment
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Catalogue No. CW 69-4/24
Photo: Art Sows
Design: Gottschalk + Ash Ltd.

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**Canadian Wildlife
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**Hinterland
Who's Who**

Chipmunk



Chipmunks are the smallest members of the squirrel family. In North America they usually live in or near forest, but some species exist above the timber-line on mountains, or in the semi-desert regions of the western United States where bushes dominate the landscape. They are found as far north as the Yukon and as far south as Mexico; but not on the Arctic tundra, the grasslands of the Great Plains, or in the hot, sub-tropical forests of Florida. Water-logged soils are usually avoided, apparently because they are not good for burrowing.

Where they occur, chipmunks can be numerous, especially if the surface of the ground is disturbed by fallen logs, logging roads, ravines, or piles of brush or rock. Chipmunks wander long distances from their burrows when gathering food, and require cover of this kind to escape from predators. If the forest consists of tall, mature trees, with few plants on the shady forest floor, chipmunks will choose forest edges such as streams or clearings, where bushes are more abundant. Mature forests do not provide abundant food and cover for chipmunks.

Chipmunks probably originated in Asia, where they are abundant and widely distributed today. They entered North America by a land connection with Asia across the Bering Sea. This land connection probably appeared and disappeared many times in the last 60 million years, and the present North American chipmunks may be the result of many invasions from Asia.

General appearance

Chipmunks can be easily recognized by the light and dark stripes on the back and head. They may be sometimes confused with some of the ground squirrels, which are also striped; but on these larger squirrels, the stripes are confined to the back and do not continue forward onto the head, as they do on chipmunks.

In North America there are two main kinds of chipmunks: the western chipmunk (*Eutamias*)



and the eastern chipmunk (*Tamias*). Both chipmunks have five dark stripes and four light stripes, but in the eastern chipmunk two of the light stripes on the back are more obvious than, and twice as wide as, any of the other stripes. The fur on the back and sides is coloured in a variety of shades of black, brown, and grey, but on the belly the colour lightens to white or buff.

The eastern chipmunk is large (weight about 3½ ounces) with a relatively short tail (about one-third of the total length), while the western chipmunk is smaller (about 2 ounces) with a relatively longer tail (nearly half of total length). Eastern chipmunks are between 8 and 11 inches long, and western chipmunks are 7 to 10 inches long.

Chipmunks can also be identified by their calls. When surprised, a chipmunk runs quickly along the ground giving a loud, rapid series of chirps and chitters. This sudden burst of noise probably startles predators, helping the chipmunk to escape. Chipmunks also frequently call with a high-pitched chirp, repeated over and over at intervals of one or two seconds. This scolding call is given when the chipmunk is watching an intruder from a safe vantage point, such as a log or tree limb.

Burrows

Chipmunks are burrowing animals and construct tunnels and nests beneath the ground. The entrances of their burrows are usually well concealed beneath rocks or tangled brush.

Only a few chipmunk burrows have ever been dug up by naturalists. Some burrows have tunnels that branch and lead to side-tunnels and accessory chambers. Most burrows, however, consist of a single entrance leading to a single, unbranched tunnel, which slopes gradually to a depth of one-and-a-half to two feet.

At the end of the tunnel is a round nest-chamber about six inches in diameter. In this chamber the chipmunk constructs a nest using insulating material such as dried grasses, shredded leaves, or the fluffy seed heads of certain plants. Seeds are stored beneath the nest and it is in this chamber that the chipmunk spends the coldest part of the winter, curled up on top of its food supply.

Breeding and the production of young

Male chipmunks are the first to emerge in the spring and are usually active as soon as patches of bare ground begin to appear through the snow. The testes of males may be fully developed when they first appear above ground. Females become active one to two weeks later than the males, and breeding begins as soon as the female emerges. In Canada, the chipmunk breeding season is April and May, and most of the breeding is accomplished from mid-April to mid-May. Females alone are responsible for rearing the young. The testes of males decrease in size fol-

allowing the breeding season, and males are usually incapable of breeding by the end of May.

Embryos in the uterus of the female require about 30 days to develop to full term, but this gestation period has never been accurately measured. The usual number of young in one litter is four, five, or six, but litters as small as one and as large as eight have been recorded. In Canada, chipmunks have only one litter and one breeding season per year, but in southern United States both eastern and western chipmunks can produce two litters in a single year.

Growth of the young

Young chipmunks are born naked and blind in an underground nest and weigh between 2.5 and 3.0 grams at birth. Hair does not become visible to the unaided eye until about 10 days of age. The ears are closed until the 28th day, and the eyes first open at 32 days of age.

When they are five or six weeks old, the young chipmunks may begin to leave the burrow to forage on the surface of the ground. At first they are quite unafraid, but after a few days above ground they are more easily alarmed and escape quickly if disturbed. The young grow rapidly during the late summer and reach adult size before the end of September. Some breed in their first spring, others not until their second year.

Dispersal

In the weeks after young chipmunks first leave the nest, they become increasingly adept at locating food and escaping from enemies. Within two to four weeks, each young chipmunk leaves the burrow of its mother and establishes a burrow of its own. Most of this dispersal occurs during August and September, and young chipmunks sometimes travel long distances before finding a suitable home. Movements ranging from a few yards to more than one mile have been recorded. Adult chipmunks, especially males, may live for some months or years in one area, and then move to a new home. Female chipmunks normally spend most of their lives within an area of several acres.

Food habits

A chipmunk spends much of his day collecting and storing seeds, which are his most important source of food. Thin membranous pouches inside the cheeks hold the seeds while the animal is busy collecting. When the cheek pouches become full, the chipmunk deposits the seeds beneath its underground nest, or hides them on the surface of the ground, covering them with leaves and other litter.

In spring, seeds are usually scarce and difficult to find. Chipmunks diligently search the ground surface for any seeds that remain from the previous summer. Green leaves and shoots are eaten in large amounts in spring, but gradually become less important in the diet as new seeds become

available in summer. Throughout the spring, summer, and autumn, the diet is supplemented with insects, flowers, fruits, mushrooms, and occasionally, eggs.

When the first ripe seeds appear in mid-summer, chipmunks remove them from the plants and begin to store them underground. The chipmunk holds fruits and seeds with its dexterous front paws, and with the teeth and tongue removes the seeds and shifts them backward into the cheek pouches. The lower incisors are especially long and directed forward. These specialized teeth enable the animal to separate and remove tiny seeds from the pods.

Hibernation

Near the end of July, chipmunks begin to collect large quantities of seeds and store them below ground. By October, each chipmunk has accumulated between one-half and one pint of seeds. With the aid of this food store, the chipmunk survives the winter.

Unlike ground squirrels, chipmunks do not accumulate body fat during the summer months, although some may do so just before they enter hibernation. Consequently, while many ground squirrels are already hibernating in October, chipmunks are still actively storing food.

With the onset of winter in November, chipmunks disappear below ground and hibernation begins. During hibernation, the body temperature, rate of breathing, and rate of heart beat drop to very low levels, reducing the amount of energy required to maintain the chipmunk. Chipmunks are not deep hibernators and are thought to awaken periodically and consume part of their food supply. They have occasionally been seen above ground on warm winter days.

A second view of chipmunk hibernation has more recently been suggested. According to this view, chipmunks do not actually hibernate until their food supply has been completely exhausted. Thus, hibernation may be an emergency survival measure. Only two chipmunks have ever been excavated in winter in a state of hibernation, and neither of these animals had a supply of food. At present, it is not known which view of chipmunk hibernation is correct.

With the first warm spring days of March, chipmunks begin to emerge, sometimes burrowing up through several feet of snow to reach daylight.

Enemies and limiting factors

Chipmunk numbers usually do not vary much from year to year, but local declines and disappearances have been recorded. These mysterious declines have never been satisfactorily explained.

Chipmunks must practise constant vigilance to avoid their many predators, including hawks, weasels, coyotes, martens, foxes, and snakes. Nevertheless, chipmunks generally comprise only a small part of the diet of such predators and the main reason for this is that chipmunks are

not very abundant. No predator can afford to specialize exclusively on chipmunks when mice are more abundant and more easily caught.

In addition, some chipmunks die as the result of wounds received in fights during the breeding season. Defence of territory is not well understood in chipmunks, but females have been observed defending their nests and young against other chipmunks.

Disease and food shortage may also limit the number of chipmunks but, once again, little is known about them. Disease epidemics have not been reported from chipmunks, but are known to occur in populations of mice and other rodents. Since chipmunks are dependent on a store of seeds for winter survival, any failure of these seed crops could jeopardize their survival.

Importance to man

Through their habit of storing seeds beneath the surface litter, chipmunks are important in the dispersal of seeds. Any such partially buried seeds that are not consumed stand a better chance of germination than those falling on top of surface litter. In this way, chipmunks assist the spread of shrubs, trees, and other seed plants.

If chipmunks are very abundant, they can prevent normal reforestation of some evergreen trees, especially pines, by eating the seeds. It is occasionally necessary to control chipmunks and other rodents with poison to ensure adequate germination and growth of seedlings. Poisoning is not a satisfactory means of control, because of the harmful effects on other kinds of wildlife. Beneficial gamebirds and insect-eating songbirds may also be killed by the poison.

Much of the value of chipmunks lies in the pleasure they provide for campers, hikers and anyone who enjoys the country. Our national and provincial parks would be less interesting and less enjoyable without chipmunks dashing across forest trails, or scrounging food in campgrounds.

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How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916,

there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Migratory Birds Convention Act and Regulation for the federal government. In practice, federal and provincial governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's National Parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a biometrician and a pesticides unit. The head office is in Ottawa and there are regional offices in Edmonton and Ottawa. Smaller offices are located across Canada, from Whitehorse, Yukon Territory, to St. John's, Newfoundland.

The Service administers over 90 migratory bird sanctuaries throughout Canada. It is now participating with the provinces in a major program of preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program was announced on April 6, 1966, that provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province, please contact the director of your provincial fish and wildlife department.

Written for the Canadian Wildlife Service
by David Sheppard. Photo of western chipmunk
by Hans Dommasch.

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Canadian Wildlife
Service

Hinterland Who's Who

Downy
Woodpecker

Downy Woodpecker



Woodpeckers are a family of birds sharing several characteristics that separate them from other avian families. Most of the special features of their anatomy are associated with the ability to excavate wood. The straight, chisel-shaped bill is formed of strong bone overlain with a hard covering and is quite broad at the nostrils in order to spread the force of pecking. A covering of feathers over the nostrils keeps out pieces of wood and wood powder. The pelvic bones are wide, allowing for attachment of muscles strong enough to move and hold the tail, which is so important for climbing. Another special anatomical trait of woodpeckers is the long, barbed tongue that searches crevices and cracks for food. The salivary glands produce a sticky, glue-like substance that coats the tongue and, along with the barbs, makes the tongue an efficient device for capturing insects.

There are 198 species of woodpeckers found throughout the world, 13 of them occurring in Canada. The smallest and perhaps most familiar of the species found in Canada is the Downy Woodpecker *Picoides pubescens*. It is similar in appearance to the larger Hairy Woodpecker *Picoides villosus*. Both are black and white with a broad white stripe down the back from the shoulders to the rump. The wings are checkered in a black and white pattern that shows through on the wings' undersides, and the breast and flanks are white. The crown of the head is black; cheeks and necks are adorned by black and white lines. The males of both species have a small scarlet patch, like a red pompon, at the back of the crown.

Although they look very much alike, the Downy and the Hairy Woodpecker have distinguishing characteristics. The Downy's outer tail feathers are not all white as are the Hairy Woodpecker's, but are barred with black. The Downy is about 6 cm smaller than the Hairy, measuring only 15–18 cm from the tip of its bill to the tip of its tail. And the Downy's bill is shorter than its head, whereas the Hairy's bill is as long as or longer than its head length.

Male and female Downy Woodpeckers are basically the same size, weighing in the range of

22–33 g. The females have a longer tail and slightly shorter bill.

Like most woodpeckers, the Downy is a climber. Its short legs and two toes pointing forwards and two backwards on each foot give the bird an excellent grip for climbing. It climbs by propping its stiff, sharply pointed tail feathers against the support while shifting its leghold. With its body close to the trunk or branch and its head bobbing, the bird “hitches” upwards, backs down spiralling, and nimbly darts sideways at incredible speed.

Distribution

The Downy Woodpecker occurs over the greater part of the North American continent, from the Gulf states northwards. In Canada in the northernmost part of its range, it is found from Newfoundland across to James Bay, the northern Prairie Provinces, the southern Mackenzie District of the Northwest Territories, northern British Columbia, and the Yukon. Downys in the northern parts of the range migrate southward in the winter, but these migrations are somewhat irregular, depending on the available food supplies.

Habitat

Woodpeckers live where trees grow. The Downy Woodpecker is at home in a variety of wooded areas across its range, in the northern mixed forests and in the deciduous (broad-leaved) forests farther south, in woodlots and parklands, in orchards, and even in the parks and avenues of suburb, town and city. It prefers places where broad-leaved trees, such as poplars, birches and ashes, let in the light among the evergreens. Forest edges and areas around openings in the denser forests are also favoured places. In the western part of its range it can be found in alder and willow growth. The Downy shares these habitats with other kinds of woodpeckers, but there are differences in their selection of nest sites and in their choice of food. Each species thus occupies its own niche in the environment.

Breeding

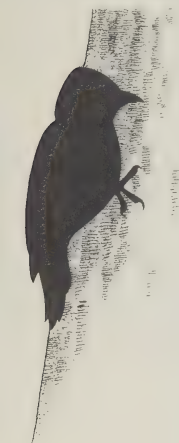
Downy Woodpecker pairs often return to the same nesting area of approximately 2 ha every year of their adult life. Male and female Downys sometimes occupy separate sleeping holes in the trunks of trees, and they may even select the same sleeping holes they had excavated in a former season.

As early as February or March a Downy Woodpecker pair indicate occupation of their nesting site by flying around patrolling it and by drumming short, fast tattoos with their bills on dry twigs or other resonant objects scattered around the territory. The drumming serves as a means of communication between the members of the pair and informs other Downys of their occupation of the land. Downys also have a variety of calls. They utter a “tick, tchick, tcherrick,” and both male and female add a sharp whinnying call during the nesting season.

During the breeding season Downy

Downy Woodpecker range





Woodpeckers defend their territory against trespassers of their species. Encounters with intruders result in hostile displays: the opponents parade in front of each other in threatening poses, bills gaping, wings raised and fully opened, the birds twisting and turning like small windmills. The Downy male engages the male trespassers and the female the females, while their respective partners look on. These demonstrations may go on for several hours but seldom end in actual fighting. Usually the intruder is chased away or simply disappears.

After establishing their territory the Downy pair look for a suitable tree in which to excavate their nest cavity. They are especially attracted to dead trees or stubs dotted with old holes from former nestings. They may start several holes in different trees before the final choice is made, usually by the female. The entrance hole may be anywhere from 1.5 to 18.0 m above the ground, but is usually from 3.6 to 9.0 m.

The pair require about two or three weeks to excavate their nest hole, which has the form of a flask 12–15 cm wide and about 20–30 cm deep. The entrance is through a short narrow neck at the top.

The male does most of the drilling. He spends nearly half of the daylight hours each day working on the hole in average sessions of about 20 minutes, resting and feeding in between. First he chisels out the passage, making it just wide enough for himself and his mate to squeeze through. Laboriously he taps and digs out the walls of the cavity, widening and deepening the room inside and throwing the loose chips out over his shoulder. When the hole is deep enough to allow him to turn around inside, he brings the chips out in his bill and scatters them with a shake of the head. Henceforth he usually sleeps in the cavity at night.

The female occupies herself flying around, feeding, and chasing intruders. When the nest hole nears completion, she becomes more interested in it and begins to work on it diligently. The pair devote most of their free time to courtship involving calling and drumming, pursuits and displays.

The female Downy Woodpecker usually lays four or five white eggs and occasionally six or seven. During the egg-laying, male and female take turns guarding the nest by sitting in the doorway.

After incubation of the eggs starts, the birds take turns warming them during the day in shifts lasting from 15 to 30 minutes. Most change-overs take place directly and immediately at the nest. At night the male remains on the eggs alone while the female sleeps elsewhere. In this manner, the eggs are covered nearly all of the time during the Downy Woodpecker's 12-day incubation period.

The young

When the young woodpeckers hatch, they are tiny helpless creatures, almost naked, sprawled at the bottom of the cavity. For a few days the

parents warm the nestlings as they did the eggs and occasionally bring them small insects for food.

As the nestlings grow, the parents gradually stop brooding and spend more time collecting food for their young. When the parent arrives with food in the bill there is a swell in the nestlings' chirping noises from within the nest. The parent dives headfirst into the cavity and touches the swollen corner of a nestling's mouth with its bill. As the mouth springs open the parent pushes the meal down the nestling's throat. And while the nestling subsides, the parent picks up a dropping and flies away with it.

Thus the nestlings are fed and their nest is kept clean until they are 17 or 18 days old, when they are almost fully grown. They look like their parents, except that the crowns of the young males are tinted red or rust-red or pinkish, and those of the females are striped or dotted with white. The young ones are now able to crawl up the walls of the cavity and take turns sitting in the doorway, looking out. To meet the nestlings' increasing demands for food, the parents bring large meals about every three minutes. Each of four nestlings is therefore fed four or five times in the hour.

As the time approaches for the young to leave the nest the parents slow down the feedings, making the nestlings livelier and hungrier. The one in the doorway pops in and out with great vigour and calls loudly, but is in no hurry. Almost a day passes before the fledgling, now as large as its parents and spotlessly clean, pops out far enough to spread the untried wings. Once outside it is able to fly quite a distance before it achieves a safe landing.

When the fledglings are all out, they hide among the green leaves in the tall trees and call for the parents to come and feed them. Within a week they begin following the parents, begging for food with sharp calls and flapping wings. At the age of three or four weeks the young birds are fully capable of looking after themselves. It is at this stage in the life cycle that mortality is greatest, when the young are out of the nest and no longer protected by the vigilance of their parents.

Moult

The adult birds begin to moult their worn and dirty plumage while the young are still in the nest. The strong, central pair of tail feathers is moulted only after all the other tail feathers have been replaced. This ensures that the woodpecker's climbing ability is not hampered during the moulting period. The complete moult takes about two months, during which time each bird keeps much to itself, resting and feeding. When the moult is over in September, the Downy Woodpecker emerges with the white part of its fresh winter plumage showing a faintly yellow tinge that eventually is lost by wear.

The young Downy Woodpeckers also shed their juvenile plumages. Their moult starts in late summer and ends in full adult plumage. Their crowns are jet black, and at the back of

the head the young males wear the bright red spot of the adult.

Food and feeding

In the spring and summer the Downy Woodpecker feeds on free-flying and hidden insect life, as it becomes available. After the young hatch, the need to select food suitable for the nestlings at various stages of growth and gradually to increase the speed of the feedings compels the Downy Woodpecker to seek larger and more easily caught prey, such as caterpillars, mayflies, and moths. It also takes small wild fruits in season.

After the nesting season, the Downy Woodpecker resumes its specialized feeding habits. It hunts down myriads of small insects and larvae that infest trees and lie hidden in cracks and crannies along branchlets, twigs, and down the trunk. The Downy's small size enables it to hunt along the upper branches of trees, while the larger heavier woodpecker species concentrate on more solid areas such as the trunk. Unlike some other species, such as the Red-headed Woodpecker, Downy Woodpeckers do not cache food for winter. During the winter a pair of Downy Woodpeckers may do a thorough job of ridding an infested tree of tiny scale insects. With its sharp bill boring small round holes or prying open the insects' hiding places, the woodpecker fetches out its food with its long agile tongue. Often the birds spend most of the daylight hours going over areas of good yield in the same trees, until they retire just before sunset, each to its own sleeping hole in the trunk of a tree.

Enemies

The woodpecker's first response to danger is to use a tree trunk or branch as a shield. Many a Downy Woodpecker has saved itself from the grasping talons of a hawk or the claws and bill of a shrike by dodging swiftly sideways behind the trunk of a tree.

Nestlings raised in holes are, of course, much safer than those in open nests. The narrow entrance to the Downy Woodpecker's nest, hewn to size, protects both the adults and the young from practically all predators except snakes. Even a squirrel, scratching and gnawing at the soft wood to get at the fledglings within, has little chance of getting past the watchful defender sitting in the passageway, its awl-like beak on the ready. But, if a Downy is caught at night behind a rotting doorway by some tree-climbing marauder, its fate is sealed.

From a human viewpoint, few wild birds have a record as irreproachable as that of the Downy Woodpecker. Its sober ways and its pest-killing activities merit our respect and attention.

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The Canadian Wildlife Service

The Canadian Wildlife Service of Environment Canada handles wildlife matters that are the responsibility of the Canadian government. These include protection and management of migratory birds as well as nationally significant wildlife habitat. Other responsibilities are endangered species, control of international trade in endangered species, and research on wildlife issues of national importance. The Service co-operates with the provinces, territories, Canadian Parks Service, and other federal agencies in wildlife research and management.

For more information about the Canadian Wildlife Service or its other publications, please write to:

Distribution Section
Canadian Wildlife Service
Ottawa, Ontario
K1A 0H3

Également disponible en français sous le titre *Le pic mineur*.



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Canadian Wildlife
Service

Service canadien
de la faune

A member of the Conservation
and Protection family

Published by Authority of
the Minister of Environment
Minister of Supply and Services
Canada, 1973, 1989
Catalogue No. CW-4/47/1989E
ISBN 0-662-17061-X
Text: Louise de Kiriline Lawrence
Revised by K. Dickson, 1988
Photo: V. Crich

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- H38 c.2

Downy Woodpecker



The Downy Woodpecker (*Dendrocopos pubescens*) is the smallest and one of the most familiar North American woodpeckers. It is similar in appearance to the larger Hairy Woodpecker (*Dendrocopos villosus*). Both are black and white with a broad white stripe down their backs from the shoulders to the rump. Their wings are checkered in a black and white pattern which shows through on the wings' undersides, and their breasts and flanks are white. The crown of their heads is black; and their cheeks and necks are adorned by black and white lines. The males of both species have a small scarlet patch, like a red pompon, at the back of the crown.

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Woodpeckers live where trees grow. The Downy Woodpecker is at home in a variety of wooded areas across its range, in the northern mixed forests and in the deciduous (broad-leaved) forests farther south, in woodlots and parklands, in orchards, even in the parks and avenues of suburban, town and city. It prefers places where broad-leaved trees, such as poplars, birches and ashes let in the light among the evergreens. Forest edges and areas around openings in the denser forests are also favoured places. In the western part of its range it can be found in alder and willow growth. The Downy shares these habitats with other kinds of woodpeckers, but there are differences in their selection of nest sites and in their choice of food. Each species thus occupies its own niche in the environment.

Breeding

Downy Woodpecker pairs often return to the same five- or six- acre nesting area every year of their adult life. Male and female Downys sometimes occupy separate sleeping holes in the trunk of trees, and they may even select the same sleeping holes which they had excavated in a former season.

As early as February or March a Downy Woodpecker pair indicates occupation of their nesting site by flying around patrolling it and by drumming short fast tattoos with their bills on dry twigs or other resounding objects scattered around the territory. The drumming serves as a means of communication between the members of the pair and informs other Downys of their occupation of the land. Downys also have a variety of calls. They utter a *tick*, a *tchick*, a *tcherrick*, and both male and female add a sharp whinnying call during the nesting season.

Downy Woodpeckers defend their territory against trespassers of their species. Encounters with intruders result in hostile displays: the opponents parade in front of each other in threatening poses, bills gaping, wings raised and fully opened, the birds twisting and turning like small windmills. The Downy male engages the male trespassers and the female the females, while their respective partners look on. These demonstrations may go on for several hours but seldom end in actual fighting. Usually the intruder is chased away or simply disappears.

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anywhere from 10 to 40 feet from the ground.

The pair require about two or three weeks to excavate their nest hole which has the form of a flask five or six inches wide and about eight to twelve inches deep. The entrance is through a short narrow neck at the top.

The male does most of the drilling. He spends nearly half of the daylight hours each day working on the hole in average sessions of about 20 minutes, resting and feeding in between. First he chisels out the passage, making it just wide enough for himself and his mate to squeeze through. Laboriously he taps and digs out the walls of the cavity, widening and deepening the room inside and throwing the loose chips out over his shoulder. When the hole is deep enough to allow him to turn around inside, he brings the chips out in his bill and scatters them with a shake of the head. Henceforth he usually sleeps in the cavity at night.

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After incubation of the eggs starts, the birds change about warming them during the day in shifts lasting from 15 to 30 minutes. Most change-overs take place directly and immediately at the nest. At night the male remains on the eggs alone while the female sleeps elsewhere. In this manner, the eggs are covered nearly all of the time during the Downy Woodpecker's 12-day incubation period.

The young

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Moult

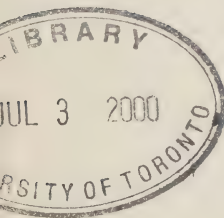
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The young Downy Woodpeckers also shed their juvenile plumages. Their moult starts in late summer and ends in full adult plumage. Their crowns are jet black and at the back of the head the young males wear the bright red spot of the adult.

Food and feeding

In the spring and summer the Downy Woodpecker feeds on free-flying and hidden insect-life, as it becomes available. After the young hatch, the need to select food suitable for the nestlings at various stages of growth and gradually to increase the speed of the feedings compels the Downy Woodpecker to seek larger and more easily caught prey, such as caterpillars, mayflies and moths. They also take small wild fruits in season.

After the nesting season, the Downy Woodpecker resumes its specialized feeding habits. It hunts down myriads of small insects and larvae which infest trees and lie hidden in cracks and crannies along branchlets, twigs and down the trunk. The Downy's small size enables it to hunt along the upper branches of trees, while the larger heavier woodpecker species concentrate on more



solid areas such as the trunk. The Downy in certain areas pays particular attention to the white birch. During the winter a pair of Downy Woodpeckers may do a thorough job of ridding an infested tree of tiny scale insects. With its sharp bill boring small round holes or prying open the insects' hiding places, the woodpecker fetches out its food with its long agile tongue. Often the birds spend most of the daylight hours going over areas of good yield in the same trees, until they retire just before sunset, each to its own sleeping hole in the trunk of a tree.

Enemies

The woodpecker's first response to danger is to use a tree trunk or branch as a shield. Many a Downy Woodpecker has saved itself from the grasping talons of a hawk or the claws and bill of a shrike by dodging swiftly sideways behind the trunk of a tree.

Nestlings raised in holes are, of course, much safer than those in open nests. The narrow entrance to the Downy Woodpecker's nest, hewn to size, protects both the adults and the young from practically all predators except snakes. Even a squirrel, scratching and gnawing at the soft wood to get at the fledglings within, has little chance of getting past the watchful defender sitting in the passage way, its awl-like beak on the ready. But, if a Downy is caught at night behind a rotting doorway by some tree-climbing marauder, its fate is sealed.

From man's viewpoint, few wild birds have a record as irreproachable as that of the Downy Woodpecker. Its sober ways and its pest-killing activities merit our respect and attention.

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Environment Canada
Wildlife Service

Environnement Canada
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Issued under the authority of the
Honourable Jack Davis, PC, MP
Minister of the Environment
© Information Canada, Ottawa, 1973
Catalogue No. CW 69-4/27
Text: Louise de Kiriline Lawrence
Photo: V. Crich
Design: Gottschalk+Ash Ltd.

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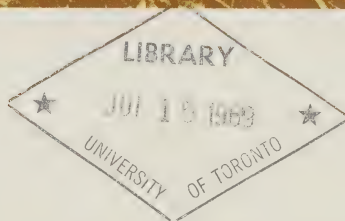
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Gannet

of the North Atlantic
(*Morus bassanus*)

In mid-May the gannets of the Atlantic seaboard — some 60,000 all told, come to the half-dozen islands and capes of Newfoundland and the Gulf of St. Lawrence where they nest.

The gannet is one of the most striking of our coastal birds—a magnificent aerialist and fishing bird with a wingspread of six feet. Consequently, it has attracted the attention of mariners from the earliest days. Jacques Cartier, in describing the islands of the Gulf of St. Lawrence, said, "These ilands were as full of birds as any medow is of grasse, which there do make their nestes; and in the greatest of them there was a great and infinite number of those that wee cal margaulx, that are white and bigger than any geese". These were without doubt gannets.

Gannets nest in colonies. Cartier's original description, written well over four centuries ago, would still fit such major nesting grounds as Bonaventure Island, where close to 15,000 pairs nest; or Bird Rocks, with 10,000 pairs; or

Newfoundland's Cape St. Mary's, with some 3000 pairs. Other nesting colonies are Cape St. Mary on Anticosti Island (1,500 pairs), Funk Island (2,700 pairs), and Baccalieu Island (200 pairs).

Approaching a major gannetry like Bird Rock by boat, an observer might suppose that the ledges of the high sandstone cliffs, and much of the top of the island, were covered with snow, so closely spaced are the brilliant-white nesting birds. Above the island the air is filled with a cloud of circling birds—the mates of those on the nests.

Appearance

In the air the gannet is supremely graceful. The wings of an adult bird may span six feet or more, and are narrow, tapered toward the ends, and swept back slightly, like a gull's. The long strong beak extends forward in flight, tapering smoothly into the small head, which merges with a thick neck that in turn joins the body in a clean, smooth contour. The legs are carried tucked well up under the smoothly tapering tail. Viewed from any angle, the gannet's shape appears to offer minimum resistance to air flow.

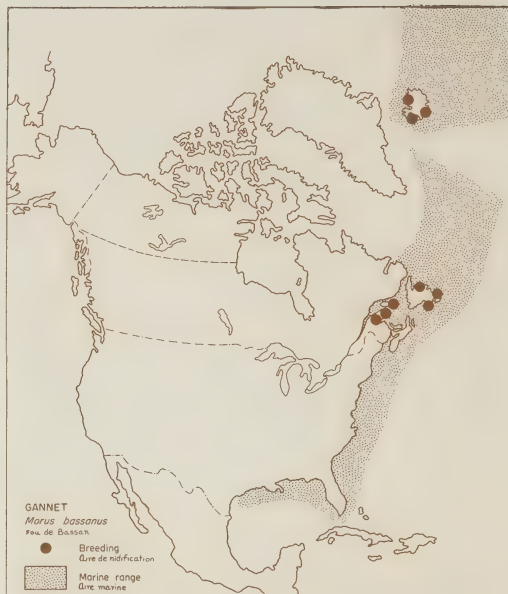
An adult gannet is dazzling white except for narrow spectacles and tapering wing-ends, which are jet black. During the breeding season the head and neck assume a delicate saffron yellow tinge.

Young gannets in autumn plumage are black with numerous white flecks, gradually becoming whiter each season until, in their third year, they achieve adult plumage.

On land the gannet is slow and clumsy, with its short legs and large webbed feet. Although a fast and powerful flyer, its landing techniques are often faulty, and may cause it to tumble in an ungainly way as it touches down.

Nesting habits

Gannet nests are rudimentary affairs, usually located on ledges on cliff faces such as the red sandstone abutments of Bonaventure Island and Bird Island, and sometimes on the top of an island. The nests are occupied year after year, and grow from a low collection of stocks, moss, and debris into a substantial heap as the litter of feathers, fish skeletons, and guano accumulates from many generations of nesting. Nests five feet in height have been found. In the moss-lined bowl-shaped hollow at the top of the debris heap a single egg is laid. It is bluish white with



an over-layer of dull white calcareous substance which becomes dirty as hatching progresses.

Courtship, with much formal bowing and spreading of wings, begins early in June and continues even after the young have been hatched. Egg laying may begin in late May, and by mid-June most of the eggs have been laid. In the first week of July the first young gannets emerge from their shells. A newly hatched gannet is livid gray, a naked, helpless little creature which sprawls in the nest whining like a puppy. It is tended carefully by its parents, and after about three weeks is covered by a protective coat of soft white down.

Growth of the young

Until old enough to take to the ocean and fend for themselves, the young are fed by the parents. Feeding is a grotesque performance, with the young bird reaching deep into the parent's throat for its feed of partially digested fish which the parent regurgitates during the feeding process. As the young bird grows older the parents regurgitate near the nest, and the youngster feeds without further aid. When the young bird is about six weeks old, plumage begins to appear, and by September it may be

ready for flight. The first plunge from the rock ledges to the water below is made only after days of hesitation, and the young bird half flies, half tumbles on inexperienced wings to the water—or, occasionally, to the rocks below, from where, if uninjured, it makes its way to the ocean. Once in the water the young gannet swims away from land, living for days on its body fat until, with practice and loss of weight, it finally is able to launch into its first real flight and begin its life of soaring and fishing.

Fishing methods and food habits

Of all sea-birds, few are more spectacular in their fishing methods than the gannet. Fishing gannets may fly as individuals or groups, usually cruising at 60 to 100 feet. Unlike most birds, they have binocular vision—that is, their eyes are so positioned that they can see forward with both eyes, which presumably gives them “depth perception”—the ability to judge distances accurately. When a gannet sees a fish in the water below, it dives more or less vertically, as a kingfisher does, with partially folded wings and at great speed. Its impact with the water may toss spray as high as 10 feet, and the momentum of its dive is thought to carry the bird below its prey. Swimming strongly with the aid of its large webbed feet and possibly at times with its wings, the gannet rises to capture its victim. On reaching the surface or even before, it swallows the fish and takes off to resume its hunting or return to the gannetry to feed its nestling. When a gannet dives, this may signal other cruising gannets nearby that a shoal of fish may be present, and they fly to investigate. They attack a large shoal in great numbers.

The gannet is well-equipped by nature for these spectacular plunges from great height. Its binocular vision enables it to estimate how far the fish are from the surface of the water. Its four-inch, strong, streamlined bill has no nostril holes to be affected by the impact with the water. Its upper and lower bills fit together tightly enough that little if any water is forced into the mouth on impact with the surface. Its body is streamlined, reducing the shock of its impact with the water, and in addition the gannet has a system of air cells between the skin of its neck and shoulders and the muscle beneath. As the gannet prepares to dive, these air cells inflate and cushion the impact. Its dense layer of feathers is conditioned with oil; con-

sequently the gannet does not become wet to the skin during its dives.

Gannets do not always dive so spectacularly when feeding. When a shoal of fish is close to the surface, a bird may rise only a few feet before plunging again. Or it may occasionally beat its way over the surface of the water with the aid of wings and feet, with its head under water to see the fish, until it is satiated with food.

The gannet is a voracious feeder, and consumes large quantities of herring, mackerel, pollock, whiting, haddock, salmon, sea trout, pilchard, anchovy, and probably other species. Gannets catch more of these fish than they actually consume, because parasitic birds, particularly the gull-like skua, seek to snatch the food from a gannet's mouth before it is swallowed. Failing this, a skua may pursue the gannet through the air, harrying it until it disgorges the contents of its stomach—the skua often deftly catching this booty before it reaches the water. There are reliable records of a skua twitching the tail of a gannet in flight to cause it to disgorge.

Distribution and related species

The world population of North Atlantic gannets is not very high as sea-bird populations go. There are about 60,000 on the Atlantic coast of North America, all of which nest in the Gulf of St. Lawrence or the east coast of Newfoundland. Iceland has three or four gannetries, with somewhat fewer birds than those of the Atlantic seaboard. There are more than a dozen gannetries in the British Isles, the Shetlands, and the Faeroes, which contain more than half the total population of the North Atlantic.

Three other subspecies of gannet exist in the world: one breeding on the southern coast of Africa, one in Tasmania, and the other in New Zealand.

The gannet belongs to the pelican family, as do the cormorants and shags of the North Atlantic, and the darters, boobies, frigate birds, and tropic birds of the southern latitudes.

After nesting is finished and the young have flown the nest, the gannets of the Atlantic seaboard disperse southward, where they hunt the sea for food during the winter, over a wide area off the United States coast between New England and Florida.

Seldom or ever does the gannet come ashore during the winter. Its strong, powerful flight

can carry it long distances in almost any weather. Or a gannet may soar for hours just above the wave-tips, seldom moving its wings. It takes advantage of the updrafts of air that ride above every wave, and are caused by the upward deflection of the wind off the windward slope of the wave. This kind of aerial performance is done with skill surpassed only by the peerless frigate-bird and the albatross. Skimming the wave-tips the gannet rises on the updraft of a wave and skims in a shallow dive to the updraft of the following wave, thus making headway against a stiff breeze without flapping its wings. Gliding flight across the wind or downwind is also possible for this aerial mariner. This type of "wave-hopping" demands almost perfect control on the part of the flyer—a type of control impossible for even the best of the high-performance sailplanes built by man.

Management

From the earliest days of settlement in North America gannets have been the prey of sea-fowlers, ships' provisioners, and of fishermen who used them as bait. One of the major destroyers of gannets, as of many other sea-bird species, is waste oil from the bunkers of ships. An oil-slick from a very small amount of waste oil spreads over many square miles of ocean. After evaporation, an asphalt-like substance remains which is sticky. When sea-birds swim in or dive through this, their feathers become matted, and less waterproof. Birds in this condition die quickly. Gannets are affected by oil, although not as severely as some species. A combination of the above hazards caused by man has caused a considerable reduction of gannet populations on our Atlantic seaboard over the centuries. Earlier estimates set the breeding population of Anticosti Island at 100,000 birds, where now the Anticosti gannetry at Cape St. Mary contains only 3,000 birds.

However, there is an optimistic side to the story of gannet conservation. They have been fully protected for several decades, and numbers are rising. A census of the world's gannets made in 1939 showed 13,000 nesting pairs in our Atlantic seaboard ganneries. The most recent estimate, made by the Canadian Wildlife Service, is 32,500 nesting pairs.

The Canadian public can do little more than it is now doing to help the gannets on their

successful rise toward their former numbers. Full protection from molesting or hunting, and a certain amount of biological research into diseases and relationships with other maritime species seem to be quite adequate to maintain a buoyant gannet population. But despite international agreements aimed at reducing disposal of waste oil at sea, and despite Canada's well-enforced regulations against dumping of waste oil in Canadian territorial waters, oil remains an important problem in sea-bird protection. In the interest of the gannets *and all other sea and shore birds*, Canadians should continue to demand an end to the destructive practice of flushing ships' oil from the bunkers into the ocean.

How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a division of the National Parks Branch, Department of Northern Affairs and National Resources, it is charged with the task of carrying out federal responsibilities with respect to wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Act for the Federal Government. In practice, Federal and Provincial Governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's National Parks; it also co-operates with the administrative agencies concerned when wildlife management programs indicated by research are instituted.

The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a pesticide investigator, and a biometrician.

For further information on wildlife in your province please contact your chief provincial game officer.

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Gray Jay



In the northern coniferous forests, the Gray Jay, *Perisoreus canadensis*, is a bird of considerable renown. Until recently, its official name was Canada Jay, as its range is predominantly Canadian. Certain races of this non-migratory bird inhabit forested areas in the United States, especially at altitudes where the vegetation and the climate correspond to those of the Canadian coniferous forests.

The Gray Jay's fearless and venturesome behaviour towards men living and working in the forest has earned it many informal names. "Whiskey-Jack" is the best known, said to come from the mispronunciation of the Indian name "wiss-ka-tjon" or "wis-ka-chon" turned into "whiskey-John". The bird is also known by half a dozen other names, such as "venison-hawk", "grease-bird", "lumberjack", "meat-bird", all of them alluding to the bird's habits and its taste for carrion.

Appearance

The Gray Jay, 10 to 13 inches in length, is slightly larger than a robin. Its tail is long and its wings short and rounded. The throat, cheeks and breast, as well as an area round as a penny covering the forehead, are pearl grey. The back of the head is dark grey, the shoulders, back and tail lighter grey, sometimes with a bluish sheen. The legs are black and light grey "whiskers" surround the base of the black bill. The jay's eyes, set in a line of dark grey, are a lustrous brown. Both sexes are alike.

The young jay out of the nest is easily distinguished from the adult by its uniformly dark grey plumage. Only the stiff flight and tail feathers are, as in the adult, edged with a lighter ashy colour. The young jay's bill is conspicuously light in colour, pink at the base, light grey from base to black tip.

All the downy parts of the Gray Jay's plumage are exceptionally silky and fluffy. Puffed out, they make the bird look larger. Some of these

downy feathers may measure two to two and a half inches in length. They provide fine insulation against the cold.

The adult jays shed their plumage once a year. In May and June after their early nesting they may be seen in a highly dishevelled state with feathers missing in wings and tail. The young jays begin their first moult in July. By late August they may have lost their dark grey juvenile dress and be indistinguishable from the adults.

Distribution and habits

In North America, the Gray Jay is found from east to west as far as north as the tree limit and south to where the northern evergreen forests end.

Fir trees and the Gray Jay belong together. From wherever the black spruces grow around bogs and muskegs, from wherever the white spruces and the balsam firs stand dense, the inquisitive Gray Jay may emerge to greet the visitor. In these areas it also nests. A condition for its nesting, whether in wet or dry places, is sufficient number of spruces and balsam firs. As nest site, the jay prefers young spruces from 10 to 25 feet in height, growing either singly or in groups.

On the ground the Gray Jay hops. Its movements are bouncing. Among the trees its flight is soft and soundless. It floats to the ground, alighting with its long tail over its back to regain lost balance. Deftly banking around tree trunks and other obstacles, the jay sails on set wings. Often with peculiar buoyancy the bird hops from one branch to the other upwards in spirals to the top of the tree. Rarely does the jay cross large open spaces, when it does, its flight is flapping and direct.

Wherever found, the Gray Jay is resident the year round. It is most often encountered singly in pairs. After nesting, it may be seen sometimes in flocks composed of families. The jay's wintering range is much larger than its nesting territory. During the fall and winter it may cover quite extensive areas in search of adequate support. On rare occasions these travels may turn into notable southward migrations.

At this time primarily the Gray Jay, in search of food, appears at the camps of lumbermen, fur trappers and hunters within its winter range. Bold and hungry, the jay investigates the premises and filches meat from caches and stores. The hunter, bending over his kill, hears a soft note, looks up and finds the jay sitting there, waiting to gorge upon the warm entrails. The farmer has a newly slaughtered carcass hanging in his barn. The door is open, the jay flies in and helps itself to meat and fat.

These practices have earned the jay a name for petty thievery. Yet few wild birds are as safe from human persecution. The jay may spring the trap the fur trapper just set in its effort to pilfer the bait. Some Indians, however, regard



Breeding range

the Gray Jay with so deep a respect that they will not give away the secret of a nest, much less harm the bird itself. Trusting and easily tamed, the Gray Jay is good company for men in lonely places.

Voice

The Gray Jay utters a great variety of notes and noises. Some are softly whistled notes, some melodiously intoned, others are sharp and harsh noises. The most commonly heard is a soft, questioning, whistled note: *yoo-yoo*, which expresses surprise or alarm. A series of quickly repeated scolding notes sound like chuckles of toneless laughter. Pairs always exchange soft notes, sometimes interspersed with harsher sounds. On rare occasions the Gray Jay will mount into the top of a spruce, or sit hidden among its branches, and sing. The song is muted, full of whistles, warbles and soft shrieks, a prolonged and very musical performance.

Breeding behaviour

The Gray Jay mates for life, but when one dies the other usually mates again. Its family life is close. When one is seen, the other is not far behind. Parents and juveniles habitually stay on together.

The start of pairing activities in the fall is prevalent among many non-migratory species in the north, including the Gray Jay. In the jay, the first sign is begging behaviour — one bird crouches, shivers its wings, and stretches the bill toward the other. At this time, this usually results in nothing more than light caressing with the bill.

As nesting time approaches, courtship behaviour intensifies. Feeding is one phase of it, and now one of the birds actually passes a morsel of food to the partner which accepts it, crouching with shivering wings. Another phase is mutual preening, when one nuzzles the feathers at the back of the other's head.

Presently the jays become interested in nesting material. They collect sticks and soft fur and drop or store it in the crotch of a twig. By late February or early March the jays begin to frequent a certain place where, eventually, the nest is built. Nests with eggs have been found in below zero temperature with snow deep on the ground.

The jays place their nest most often in young spruces or balsam firs, rarely in shrubs, at heights from four to thirty feet. They lace it securely close to the trunk, seldom out on a branch. The nest is bulky. The outside measurements of one were six and a half by seven inches. Dry sticks and dead leaves form the outer structure. Often discarded shells of cocoons, parts of wasps' nests and spiders' silk are interwoven. Next comes a thick layer of inner bark from cedar or willow. The inside of the nest cup is warmly lined with fine grasses, hairs of deer and snowshoe hare, sometimes with grouse feathers and their own down.

The Gray Jay lays from two to five eggs, most often three to four. The eggs are greenish- or

greyish-white with fine olive spots. The female incubates about 18 days before the eggs hatch. She rarely leaves the eggs. Both adults stay very close to the nest until after the young have hatched and the parents must range farther in search of food.

When the young hatch, their skin is dark blue and covered with sparse dark natal down. Their eyes begin to open about the fifth day. Both parents feed the young, offering at first semi-digested food carried in the throat. At this time, the male does most of the feeding while the female keeps the young warm. Later she assumes a greater part in the feeding. Both parents help clean the nest, carrying the droppings away.

After 15 days in the nest the young are ready to leave. Within a few days they learn to fly fairly well, but the parents continue to feed them for two or three weeks.

Food and feeding

The Gray Jay eats any kind of food. Beetles, caterpillars, grubs and ants' eggs are among its best liked insect foods. While flying, the jay can pick insects out of the air like a flycatcher. By making feints, the jay sometimes causes other birds to leave or drop their catch. Another bird's nest with eggs or young is not safe: the jay may even eat its own infertile or addled eggs. Berries in season and needles and buds of firs are also eaten.

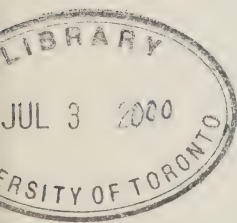
During the cold season the jay develops a special fondness for meat and fat. It may kill, carry away and eat a sick or crippled mouse or shrew, stranded on top of the snow. Belonging to the crow family, the jay is a scavenger and feeds on scraps found at dumps and campsites. Shiny things attract it and are carried away or dropped when found uneatable.

The Gray Jay stores much of its food. Holes pecked by woodpeckers have been found crammed with bread and other foods. The hollow at the top of a broken-off stump is another favorite hoarding place. Mouthfuls of food it does not want to eat at once are turned over until well coated with saliva. These sticky packages the jay then stores on ledges, in crevices or among the needles of evergreens, where they remain well preserved. Sometimes the jay buries them.

Enemies

To the Gray Jay, the falcons and the short-winged hawks that predominantly prey upon birds are the greatest menace. However, most of these migrate and are absent during the Jay's early nesting season. At this vulnerable time only the owls among the winged predators are potential enemies of the jay. In their open nest, the jay's eggs and young are preyed upon by squirrels, martens, porcupines, raccoons, and also by ravens, crows and Blue Jays.

Among birds, the Gray Jay has intelligence and graces that set it apart. We, who are not



accustomed to being approached by any wild creature without fear and anger, are charmed by its easy audacity and prompt to forgive its sins. Without the Gray Jay with its soft wingbeats, its sudden appearances out of the dark green backdrop, the austere northern forests would lose much enchantment and character.

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Grouse



Put-put-put-put-purrrrr! Have you heard this sound in the woods in spring? Throbbing like a far-off motor boat, it is the mating call of a male ruffed grouse or "drummer". Quietly stalk him and he will likely be found on a large moss-covered log at the edge of a forest opening. If you beat your fist on the ground you may stimulate him to drum.

The Indians called the ruffed grouse "the carpenter bird", because they thought it drummed by beating its wings against a log. The sound is really made by the bird cupping and rapidly beating its wings against the air. As far as we know, the drumming warns other male grouse to keep away and attracts hens when they are ready for mating.

The ruffed grouse is common throughout most of Canada and much of North America. It does not migrate and, once established, lives all its life within a few acres. Its large size, rich colours, and the explosive burst with which it takes flight are distinctive. As a conspicuous member of our forests and a most popular game bird, it adds very much to the delights of the outdoors.

The ruffed grouse is frequently called "the partridge". This leads to some confusion because of the European, or Hungarian, partridge that has been introduced to Canada. The ruffed grouse is only distantly related to the Hungarian partridge, which is more like a chicken.

Appearance

The scientific name for the ruffed grouse is *Bonasa umbellus* L. Both terms are from the Latin: *Bonasa* means good when roasted (indeed!) and *umbellus*, a sunshade. This refers to the ruff of dark-coloured neck feathers that are particularly large in the male. When he is in display before the female, these are erected and surround his head almost like an umbrella. By nodding his head and ruffs, spreading his tail and strutting, the male identifies himself to the female and en-

courages her advances. The letter "L." after the name signifies Linnaeus, a famous Swedish biologist who founded the present system of naming plants and animals, and who first described accurately and named the ruffed grouse.

The ruffed grouse is about the size of a bantam chicken and weighs one to one and a half pounds. Unlike the chicken, it has a broad flat tail which is usually held down, but may be erected and spread into a half circle.

The dappled and barred plumage ranges in colour from pale grey through sombre red to rich mahogany. In the east most grouse are predominantly grey, while others are red. Greys are in the majority in the central parts of the continent, while on the West Coast most grouse are reddish.

The colours worn by the grouse are related to the kind of habitat in which they are found: the dark colours in dark forest, as on the coast; the greys, in lighter bush. This camouflage helps protect the grouse from their enemies.

Males are hard to tell from females at a distance, but males are larger with larger ruffs and a longer tail; and in the male the broad band of dark colour in the tail is usually unbroken. In the spring, the behaviour of each sex may be quite different.

Origin and distribution

Because all records, including fossil remains, are confined to this continent, ruffed grouse are thought to have originated in North America millions of years ago. A pheasant-like ancestor probably migrated from Asia across land that bridged the Bering Sea.

Once here, the ancestral stock evolved into several lines of chicken-like birds; and one line we recognize today as grouse – the family *Tetraonidae*. Within the family, there are several different kinds of grouse that have adapted to life in various habitats. The ruffed, spruce, and blue grouse live in forest; the prairie chicken, sharp-tailed, and sage grouse are found on the prairie, prairie edge, and desert; and the white-tailed, rock, and willow ptarmigan are found in arctic and mountain tundra.

Some early forms even returned via the land bridge to Asia and Europe, where their descendants can be identified today as the capercaillie, black grouse, and hazel hen. While different in many ways and widely separated geographically, the grouse of the world show their common evolutionary origin by sharing fundamental features of their biology. For example, all male grouse seem to flutter their wings loudly during sexual display.

The differences among grouse can be explained by the way each has become a specialist in its particular habitat. Thus, the ruffed grouse is adapted to a life in hardwood bush and forest – its beak, legs and wings, and gut are adapted to permit it to feed as a browser on buds, leaves, and twigs. The bird is an excellent climber among



slender branches and on thin, yielding stems; and this possibly explains why, among the grouse, it is relatively small, with long neck, limbs, and toes. This grouse is expert at short, rapid, twisting flights, and can actually hover and make complete turns in the air — all handy traits for flying through thick bush. However, it is essentially a ground-dwelling bird.

The ruffed grouse is found wherever there are even small amounts of broad-leaved trees, especially aspen, birch, and willow, that provide the buds which are its staple winter food. And since deciduous forest occurs right across Canada from east to west, from Alaska to deep into the United States below and east of the Great Lakes, the ruffed grouse is widely distributed indeed.

The deciduous trees, important as food and shelter to the ruffed grouse, frequently occur in the early stages of forest regeneration after logging and fire. It is likely that we have more ruffed grouse now than before the white man came, because much of our coniferous forest has been cut or burned, and succeeded by aspen and other trees favoured by grouse. As these young forests grow and change from a mixture of coniferous and deciduous trees to mostly conifer, ruffed grouse populations will decline and in some places disappear. A return of large areas of old conifer forest to youth by cutting and burning, or natural catastrophe, brings back the grouse.

Life history

The life of a ruffed grouse takes its measure from the seasons; and through the year individuals make the best of what is possible. Spring is mating time. The male drums or advertises himself from a number of drum posts, usually old logs. He establishes himself among other male grouse by drumming and fighting, and stays on his territory throughout his life. Other males are chased away, and females are courted on the areas occupied by established males. Near their display posts, males find all the other requisites for life, such as roosts, shelter from weather and predators, food, and places to dust-bathe.

The hens in spring must find the food to make good eggs that will produce healthy young. Like the males, hens live alone and are spread through the forest; but, unlike them, they do not display themselves, and they move over a larger area. Wildlife biologists who have attached small radio transmitters to the backs of hens have found that hens cross trails with each other and may travel through the territories of several males and mate with several others. When they are ready to mate, hens are attracted by a drummer and will mate with him. Both males and females mate with whatever grouse presents itself at this time.

After mating, the hen selects a nest site which may be some distance from her mate and even on the territory of another male. Her nest is always on the ground and usually at the base of a

tree, stump, or rock, close to an opening and in forest that provides shelter.

The nest is simply a shallow bowl in the ground, lined with whatever is at hand and feathers from the hen. She lays from 7 to 14 eggs, and incubates them from 22 to 24 days. Most nests hatch in early June. Only one clutch is produced a year, although some hens will lay again if their first set of eggs is destroyed early in incubation. Most of the hatch in an area comes within a very few days. This timing possibly reflects the way the production of eggs is geared to the growth of new vegetation in spring.

A nest of eggs, once discovered, is easy prey for a number of birds and mammals that take the eggs for play or food. The hen will sit still on her nest almost until you touch her. She usually leaves the nest to feed in the early morning and late evening, when the uncovered eggs are hard to see. This behaviour and her camouflage of plumage are most effective, and relatively little mortality to grouse occurs through the destruction of nests.

The hen leaves the nest with her young within a day after they have hatched. The brood may then set out and travel a long distance before settling down to live upon a relatively small brood range. It appears that the hen seeks out an area that is best for the survival and growth of the young. The brood lives as an independent group, although they may pass males and other broods as they travel about.

The hen and chicks behave in many ways that protect the young, particularly before they can fly. For example, when startled by intruders the hen directs attention away from her chicks by hissing, clucking, and dragging one wing as if it were broken. She appears quite helpless and a ready meal. Try to catch her and she bursts into the air and away. Meanwhile the chicks have burrowed deeply into the litter of the forest and vanished.

Throughout the summer the chicks grow rapidly in size, weight, and plumage. They feed heavily on insects at first but always take succulent vegetation; and by August they enjoy a diet of a variety of flowers, soft leaves, berries, and some seeds. Clover is particularly attractive to broods of grouse, and they frequently find this plant along old roads through the forest. It is here that many young grouse are taken by hawks and hunters.

Starting in June, the old birds gradually moult and replace all their feathers. It is not unusual to see a grouse in late June without a tail at all! The chicks replace their natal down with a rough, poor-quality juvenile coat, then replace this with the yearling plumage by 16–17 weeks of age. This plumage is generally similar to that of the adults.

The early mortality of grouse chicks may be very high. Within a week or two after hatching, half the hens may lose all their young and the remainder may have broods about half the size of

the clutch. Recent studies suggest that the early mortality may be largely due to the kind of eggs produced by the hen. This, in turn, is influenced by her diet in winter and early spring, when she stored within herself the food reserves of her unhatched chicks.

Other mortality to young grouse is caused by accidents, predation by the fox, goshawk, and great horned owl, and diseases such as a damaging stomach worm, *Dispharynx*, which gets into grouse by way of wood lice they take as animal food. Young and old grouse may carry a number of other worms in their intestines and malaria-like parasites in their blood. These are usually harmless to the grouse. Very rarely are any diseases of grouse harmful to humans.

In autumn, when the young are almost fully grown, there is another period of relatively intense activity in the life of grouse. Males begin to drum again, and broods frequently break up as young grouse disperse throughout the forest, seeking a place of their own to live. If new grouse are driven away by established birds, they may never find a home and may die. Others may establish themselves on the territories of old birds which die.

The established birds are secure because they have obtained a place that will provide food, and shelter from weather and predation. The displaced grouse, usually young, are forced into habitat where food and cover are inadequate and are therefore "doomed to die". These grouse are an expendable surplus and may be harvested by hunters without harm to breeding stocks.

The winter may be a hard time for grouse, especially for those that do not become established on an area in fall. In winter, broad-leaved foliage is much reduced or eliminated, exposing grouse to predators as well as forcing them onto their staple winter diet of buds and twigs.

The ruffed grouse is equipped to handle winter weather, but extreme cold and wind with little snow may cause heavy mortality. Where the snow is deep, soft, and persistent, grouse travel over it with the help of their "snowshoes" – lateral extensions of the scales of the toes. They also burrow into the snow, which keeps them warm and protects them from predators.

A good winter is one with soft, deep snow that lasts. Should there be little snow or hard crust and long periods of cold and wind, grouse cannot find adequate protection. They are forced to seek shelter in clumps of thick conifer. Under these conditions grouse lose weight and suffer heavy mortality to predation. A shortage of food and bad weather may cause some grouse to die.

Observing grouse

Try grouse watching and then try to explain some of the things you observe. It is a fascinating pursuit. If you search carefully through the forest you are bound to find many evidences of ruffed grouse if they are there at all. From these

observations you can build up some idea of the activities of grouse.

Grouse droppings look like those of chickens. Drum logs are easily identified by the piles of droppings on them. Droppings and feathers show where grouse have been, roosted, or paused in hiding. Where there is sand and rotting wood, grouse will make depressions and tracks which show their dust bathing and passage. In winter, tracks and roosts in the snow and bits knocked from trees are added to the usual clues which show the presence and activity of grouse.

Management

Grouse populations are sparse in some regions and dense in others. They also may fluctuate between abundance and scarcity in the same area. These fluctuations still need better explanations. Dense and relatively stable grouse populations seem to occur most frequently in forests on rich soils. This may be explained by the better quality of food and shelter available for grouse in these forests.

The control of predators and disease does not offer much hope of increasing numbers of grouse. Hunting by humans has little effect on numbers. Most hunting is directed against young birds along the edges of roads and in openings and many of these will die anyway. Other, older and established grouse are deeper within the forest, where few hunters go.

Co-operation between forestry and wildlife managers is more likely to ensure that this attractive bird will remain abundant. By selective cutting and burning we can harvest the forest and create habitat productive of grouse.

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How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Written for the Canadian Wildlife Service
by Dr. J. F. Bendell. Photo by Paul Pohlman.

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Hawks (accipiters)



Hawks are found throughout the world, virtually everywhere there are forests. There are numerous species in the tropics, especially in the Indo-Malayan region where they probably originated. But in North America, north of Mexico, there are only three species: the Sharp-shinned Hawk, Cooper's Hawk and the Goshawk.

Other birds of prey popularly referred to as hawks, such as falcons, harriers and buzzards, are not true hawks, or *accipiters*, in the strict zoological sense. All are flesh-eating birds which hunt their food by day, however, and members of the group of birds known as *diurnal raptors*.

Both the Sharp-shinned Hawk and Cooper's Hawk are unique to North America, although they are closely related to Mexican and Central American species and probably originated there. The larger Goshawk, on the other hand, is found in Europe, Australia, central and northern Asia and parts of Africa as well as North America. It probably reached here from Asia via Siberia.

Appearance

The most notable variation is in size, which ranges from the ten-inch, ten-ounce Sharp-shinned Hawk, through the middle-sized Cooper's Hawk, to the two-foot, three-pound Goshawk. All three North American hawks are otherwise alike in appearance: their colorings are similar, and they all have small heads, long tails, and comparatively small, blunt-ended wings.

In all three species the colour of the young birds is strikingly different from that of the adults. First-year accipiters are always brown: sepia to chocolate brown above, pale tawny or yellowish brown to creamy white below. The feathers of the back are broadly edged with white or near white, and crossbarred with darker brown, giving the back a coarsely barred appearance. The pale breast and flanks are streaked lengthwise with very dark brown, and the wings and tail are crossbarred with dark bands. The eyes are amber to yellow.

In the adults, on the other hand, the upper surfaces are a uniform blue-gray in all three species. Below, the two smaller species appear reddish brown, due to broad, even crossbarring of this colour on an almost white ground. The Goshawk is similarly crossbarred below with gray, but these markings are so fine and so closely spaced as to appear a uniform pale gray at any distance. In the adults of all three species the long feathers under the tail are snowy white, and the eyes change to deep red as the bird grows older.

Their flight is most distinctive. These hawks seldom soar; they fly in a direct, purposeful way just at or a little below tree-top level with four or five quick, sharp wingbeats followed by a short glide. With an instinctive ability to be unobtrusive and unobserved, they seldom perch on tree-tops, preferring the concealment of the side-limbs of a well-foliaged tree.

Range and habitat

The range of the three North American hawks covers the entire continent from the tree line south. But of the three, only the Sharp-shinned Hawk occurs over the whole range: it can be found either as a migrant or as a nesting species from the tropics to the northern limit of trees. As a breeding bird, it very much favours the northern spruce-tree zone or boreal forest. It is by no means confined there, however, and will breed southward in almost any timbered or bushy area, especially where hills and mountains provide reasonably cool climates. It is perhaps the most abundant hawk in Canada in summer. The Sharp-shinned Hawk is intolerant of cold weather and moves southward in large numbers to winter in the tropics and sub-tropics. It is the most migratory of all North American birds of prey, and many members of the species fly the entire length of the continent in their migrations between breeding and wintering ranges.

The Cooper's Hawk has a generally more southerly breeding range, and is considerably less migratory. It is the common forest and bush country hawk of the mid latitudes of the continent: the hardwood forests of southern Ontario and the eastern United States; the bushy or lightly timbered coulees and river bottoms of the southern Canadian prairies and the plains states and the scrub-oak or mixed fir-oak forests of the western mountains. It does not penetrate the northern spruce forests at all, and it could best be described as a reluctant migrant, for although it withdraws from the northern portions of its breeding range in winter, it winters much farther north than does the little sharp-shin.

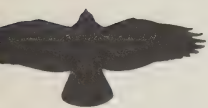
The North American Goshawk, originating as it did from a Siberian ancestral stock, is a true northerner. Its stronghold for both breeding and wintering is the broad belt of spruce, aspen and birch forest that extends right across the northern one-third of the continent from Alaska to Newfoundland. The breeding range extends southward only where high mountains and the associated cool coniferous forests provide conditions similar to those of the northern spruce forests. In the east, Goshawks are rare during the breeding season south of the 45th parallel; in the west they reach their southern limit in the mountains of northern Mexico at elevations above 10,000 feet. The species is not truly migratory, for many adults winter as far north as the species breeds. There are, however, some fairly well-defined annual movements of Goshawks, particularly in the eastern half of the continent.

The most distinctive travels of the Goshawk, however, are its great immigrations to the mid latitudes at widely spaced, irregular intervals. These apparently coincide with the cycles of the Ruffed Grouse and snowshoe hare, both favorite prey of Goshawk in the boreal forest region. Every nine or ten years, there are "crashes" in

silhouettes.



ters have short, rounded wings
long straight tails. The wings
apparent adaptation for chasing
in heavily forested areas.



have large rounded wings and
taped tails.



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the grouse and hare populations due to major die-offs, and the great birds are forced to fly south in search of other food. In those years when the die-offs of grouse and hare coincide, the Goshawk invasions of the south become even more spectacular.

Breeding and nesting

Hawks are among the most secretive of birds in their nesting activities, and their nests are seldom found except by accident. All are tree-nesters, but the requirements of the three species are somewhat different.

The Sharp-shinned Hawk likes semi-open country set with dense groves of spruce or similar trees. For its nest, it builds a relatively enormous platform — almost two feet across — on the low side-limbs of an evergreen, only 12 to 14 feet from the ground. This species raises broods of between six and eight young, the most of any raptor. Sharp-shinned Hawks are daring and pugnacious in defence of the nest and unhesitatingly attack any intruder. Only their small size prevents them from being dangerous to man, for they make hard contact when they strike.

The Cooper's Hawk prefers tall, well-grown trees for its nests. It does not like heavy, continuous forest, but rather groves of trees covering some 20 to 80 acres adjacent to open fields or grassy hillsides. The nest is nearly always well hidden in a densely foliated tree, anchored in the fork of one or two large branches and seldom less than 40 feet from the ground. The nest itself is often smaller than that of the Sharp-shinned Hawk and strongly resembles a crow's nest. The Cooper's are among the shiest of hawks: at the first sign of human intrusion they tend to slip away silently and unobtrusively. If the nest-tree is climbed, they may show themselves, but the protest is brief and attacks are almost unknown. This species lays up to five eggs but seldom raises more than four young each season.

Goshawks, in spite of their far northern or high-elevation breeding grounds, begin their nesting activities a full month earlier than either of the smaller accipiters. Two to four eggs are in the nest by early or mid April, and incubation is under way while snow is still on the ground and nighttime temperatures are well below freezing. Goshawks seem to have an absolute requirement for coniferous forest when nesting, and although the nest itself may be in a deciduous tree, that tree is usually in deep spruce or pine woods. The nest itself is usually situated in a three way fork anywhere from 20 to 70 feet from the ground, depending on the size of the timber.

Young Goshawks leave the nest in the first half of July, and once they are on the wing the adults no longer defend the nest territory. But until then any point within half a mile of a Goshawk's nest can be very dangerous, for these hawks are ex-

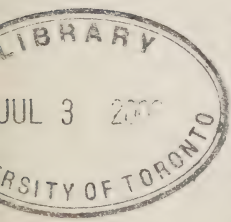
remely savage, and large enough to do real damage. Sometimes the attack is preceded by loud, excited cries, but just as often there is no warning at all, just a hard, slashing strike from the powerful, well-armed feet, generally aimed at the intruder's head and delivered with such speed and dexterity that they are almost impossible to dodge. The Goshawk is possibly the most dangerous of all North American birds, and it is just as well that it nests in remote wilderness areas and early in the year.

Food and hunting

Accipitrine hawks are primarily bird hunters. This is especially true of the smaller species in the temperate zones, and both the Sharp-shinned and Cooper's Hawks feed on little else, only occasionally taking small mammals. The Sharp-shinned Hawk's migrations follow the hosts of sparrows, finches and warblers into the northern forests in summer and back to the subtropics in winter. The Cooper's Hawk lives on the somewhat larger forest and bushland birds of the mid latitudes: robins, flickers, jays and quail. The Goshawk, on the other hand, feeds on mammals as well as birds, depending on what is available. In fact, at certain times and places mammals make up well over half its food supply. Its favourite prey includes grouse, snowshoe hares and ground squirrels.

These hawks hunt by stealth and surprise whenever possible, although they must also show great speed at times, especially when hunting other birds. Two methods of hunting are commonly used. In one, the hawk sits in a thick tree and watches for a prospective victim to move away from its cover. Once the prey is spotted, the hawk launches itself into the air very quietly, dives straight down for a few feet to pick up air speed, then flattens out and glides on motionless wings straight toward the quarry. As long as the intended victim remains unaware of its approach, the hawk does not beat its wings. But most birds do detect the gliding hawk and take flight: at that moment the hawk puts on a tremendous burst of speed in an effort to close up and make the strike before the quarry can reach cover.

A more speculative but still effective way of hunting is for the hawk to cruise along the edge of the woods, along creeks or rivers, or just below tree-top level in the woods, on the chance of surprising something far enough away from cover to attempt a high-speed dash. The distance the hawk will chase varies somewhat with circumstances, but generally the two smaller species seldom pursue a quarry much more than a hundred yards. The Goshawk is both swifter and more persistent and will press its attack on such birds as Ruffed Grouse, ptarmigan and pheasant for distance of half a mile, particularly if the flight course is across open ground.



Management

The accipitrine hawks, long considered by many people to be destructive to the song bird populations, are actually of great service to their prey species. Their method of attack tends to test the birds they hunt for alertness and speed: they pick off the sick or injured, cull out the unfit, and eliminate any that try to live in poor habitat or to feed too far from good cover. They also act as a dispersal agent in breaking up groupings of grouse and quail. Goshawks especially were once believed a serious menace to introduced game birds such as Gray Partridge and pheasant, through their infrequent invasions of the mid continent. Although they do sharply reduce the populations of these species, they do so far more selectively than hunters with shotguns, and thus ensure that the quality of these pampered birds does not deteriorate.

In recent years there has been a marked decrease in the number of hawks and other bird-eating raptors in North America. This trend began, and is most serious, among the species found in the great agricultural areas of the middle latitudes, such as Cooper's Hawk. Research has shown that there are insecticide residues in some hawks, and their population decline is probably due to indirect poisoning by insecticides. This occurs, for example, when seed grain treated with insecticides is eaten by birds. These grain-eating birds are eaten in turn by hawks. In this sort of food chain, insecticides that do not decompose much, such as DDT and dieldrin, accumulate at higher levels in each succeeding link, so that the hawks build up significantly more insecticide residues than do their prey. These residues, reaching levels poisonous enough to interfere with reproduction, are the most probable cause of the decline in hawks.

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Herring gull. Photo by Cy Hampson

Herring gull

(*Larus argentatus*)

The seashore would not be the same without sea gulls, but to gulls the shore is just one place to make a living. They belong on seaweedy, granite rocks and big tides of the Maritimes, Maine, or British Columbia; they pace the sandy flats of Cape Cod; and they stand decoratively on pilings, masts, and roof tops of busy harbours or fishing villages. They are opportunists – finding a place to live wherever there is food, water, and a place to loaf.

On the east coast the name "sea gulls" applies (from sheer weight of numbers) to herring gulls. On the west coast, from Oregon to British Columbia and Alaska, the term applies to the very closely related glaucous-winged gulls.

Relation to man

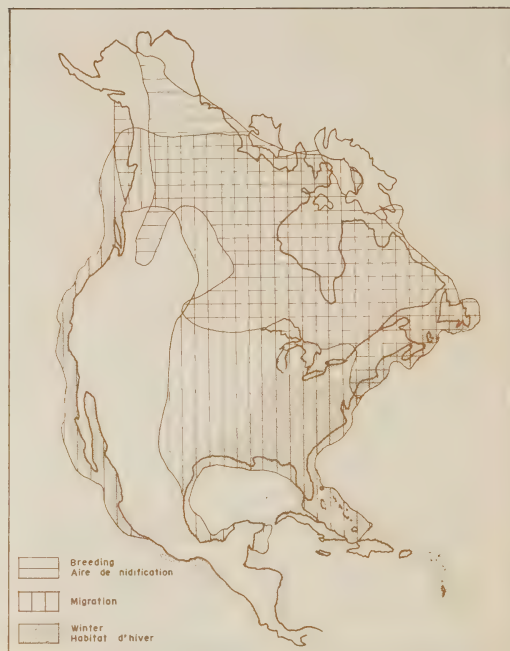
Gulls as scavengers can profit from the organic wastes of garbage, sewage, fertilizer, and fish waste dumped all around our prosperous

communities. In a mid-winter 1965 census of the Gulf of Mexico and Atlantic coasts of the United States, half the gulls found were in the metropolitan areas of Norfolk, Virginia; Baltimore, Maryland; New York City; and Greater Boston, Massachusetts. Half of the rest were near smaller metropolitan areas or fishing ports. In coastal Nova Scotia and New Brunswick in the winter of 1967, 29,000 gulls were found around the large cities and fishing ports, such as Saint John, Lockport, Liscomb, and the mouth of Halifax Harbour, and only 9,000 were found along all the miles of shore line between.

In the mid-twentieth century, gulls are so numerous as to be a pest in some places, and they thrive in close association with man. But it was not always thus. At the end of the nineteenth century, sea gulls were rare along the Atlantic coast because of persecution. In those years, many farmer-fishermen led a precarious existence on outer islands – tending gardens, fields, and flocks, and fishing with nets and lines. Any bounty from the sea was welcome, and gull eggs and young were worth considerable exertion. Then it became fashionable to use bird wings on ladies' hats, and a fee of 20 to 40 cents could be earned for each set of wings and back feathers collected for the millinery trade. With this attrition added to the taking of eggs and young, sea-bird populations reached a low ebb.

In the 1890's, Audubon societies actually paid wardens to protect several of the half dozen remaining gull colonies on the coast of Maine. Fewer than 4,000 pairs were counted in 1900 – all in easternmost Maine and New Brunswick. In 1965, however, censuses showed about 100,000 pairs on some 240 colonies, all along the shore from New York City to Grand Manan, New Brunswick. During this period, censuses of gulls made on 10 bird sanctuaries on the north shore of the Gulf of St. Lawrence showed an increase from 1,020 herring gulls in 1925 to 18,315 in 1965. Why has there been this dramatic change?

As the standard of living rose and the use of inboard engines spread, fishermen gathered into coastal villages at safe harbours, leaving the outer islands to the thunder of the surf and the cries of the sea gulls. Formal international protection became law in 1916 and, with a food supplement from garbage and



fish wastes, gulls have continued to increase apace.

They have doubled their numbers in many places every 15 years and, because they are attracted to metropolitan areas, have even become a nuisance and a hazard to aircraft flying in and out of airports. Major dumps and sewer outlets are often found near airports. Federal governments of several countries have sought ways to control gull numbers and, as a result, biologists have been encouraged to study many details of sea gull biology. These studies probably would not otherwise have been possible.

Appearance

The adult herring gull is about two feet from bill to tail and has a white head, body, and tail. Its bill is yellow with a red spot on the lower tip and its legs are flesh-coloured. Adult gulls have grey backs, and the tips of their outermost flight feathers are black with a white spot. In winter, adults' heads are heavily streaked with brown. An adult herring gull may live as long as 10-12 years.

Nesting habits

Gulls nest in colonies and once a colony is well established, they are faithful to that colony and reluctant to settle on a new island. Yet with a growing population some are excluded, and those unable to establish breeding territories loaf around abundant food supplies and established colonies. Sooner or later, these birds start to loaf on a nearby island and as the urge to breed grows some start nesting – and the rush is on. In a very few years the colony grows to capacity; for example, in Massachusetts: 25 pairs to 2,500 pairs on Thacher Island from 1959 to 1965; 50 to 500 on Norman's Woe from 1961 to 1966; 3 to 850 on Tern Island from 1962 to 1966. Then the housing development is full.

The density reached depends upon the island's terrain, not the number of gulls. Nests on a broken jumble of rocks or driftwood will regularly be 3–8 feet apart; but on grassy knobs or sand dunes, the nests will be 45–90 feet apart. Nests on an open, bald, rocky knob will be 10–30 feet apart. Thus, the characteristics of the habitat regulate how closely together gulls will crowd – a sort of zoning ordinance.

Behaviour

Although at first glance a gull colony seems a noisy, squabbling anarchy, there is a rough-hewn organization. Each pair occupies an area from which they drive other gulls and on which they nest. To occupy this territory, to find and pair with a female – in other words, to carry through the purpose of it, the continuation of life – requires communication between individual gulls. This interchange has been studied for several decades.

An early student said of birds that they have very little intellect but very intense emotions, and their communications are of moods. If a gull wants to state intent to stand fast, he gives the trumpeting "long call". If he threatens to peck a neighbour, he draws himself up to look bigger, lowers his bill-tip ready to strike, and pulls his "wrists" out of his body feathers. Then he steps stiffly toward his opponent. If his opponent stands fast, both gulls are faced with the choice between attacking or running away – a conflict situation.

Many studies have been made of what birds do and why, when two moods or drives

contradict each other. Does the energy of nervousness overflow and make the animal do something, or do the conflicting drives cancel each other out, eliminating their priority, hence unmasking other actions? All we can see is that when in conflict, gulls, like people, may stare at their feet or toy with a stick, just in the way that we doodle, scratch our heads, or smoke. Once an observer is familiar with what happens before and after each posture or call, he can read the moods and follow just what is going on.

Breeding

Biologically, it is most efficient for all members of a colony to get on with reproduction, so fighting during courtship is minimal and mostly bluff. By mid-May in most places, a clutch of eggs – three with nearly all experienced females – is laid and incubation starts. It may be asked what factors control the numbers of young produced. Why do herring gulls lay three eggs and most terns only two? It seems that the clutch size is that which on average allows parents to bring through just as many young as they can feed and shelter.

In the first breeding year (third or fourth of life) we can assume that many females do not lay a full clutch. Females often take every third or fourth year off from breeding, and apparently three-quarters of the females on a colony lay the full three-egg clutch.

On average we can expect a pair of gulls to lay somewhere around 30 eggs in their 10- to 12-year lifetime. For the population to hold its numbers during that period, only two of these need to survive, and 28 must die. If only 26 die the population doubles. Mortality is high. Studies show that 50 per cent of eggs fail to hatch, or are dead or destroyed by the end of the first week after they hatch. In New England now, a pair averages one chick per year to leave the colony at 40–60 days, but about 30 per cent of these are dead before another month has passed.

Feeding habits

How do the gulls from a colony get all they need to sustain themselves and raise their young? In 1961 and 1962, near Boston, Massachusetts, breeding gulls were caught and coloured several bright tints to trace their daily trips for food. It was apparent that the vast majority of the gulls sought their food

as close to their breeding colony as possible. If there was a fish pier within five miles, few gulls went farther. If the nearest dump was 17 miles away, commuting that far was regular; even 25 miles was not an unreasonable daily round, if there was nothing nearer and the rewards were attractive enough.

After the gulls left their islands in mid- or early August, some drifted south along the coast and a kaleidoscope of gulls was reported at loafing areas such as points on Cape Cod where gulls could go several directions to follow fishing boats. The dumps of Greater New York and resort towns of the New Jersey coast reported them too, but studies of proportions of marked to unmarked birds made in Gloucester and Boston in July–August and again in January–February showed that most of the adult gulls stayed near home. Once they have begun to breed, they apparently tend to winter next door.

We can say from these studies that a city's gull problems result from its own "effluent society". If a city cleans up its sewers and fish piers, covers its garbage and pig farms, gulls will go elsewhere. They go just as far (and no farther) than is necessary to find food, fresh water, and a peaceful place to loaf or breed. Examination of the food in gulls' stomachs shows that they will eat almost anything – clams, small fish, floating dead animals, young and adults of other nesting birds, bread, French-fried potatoes, and so on. The majority of gulls' food is "natural", but the 20–40 per cent subsidy which they get from man's wastes has created for them a booming economy.

Herring gulls have been seen to feed in most of the ways great black-backed gulls feed, including the specialized hovering or dabbling techniques used by their smaller relatives. Except where abundant food attracts all comers, species of gulls avoid competing.

Black-backed gulls are powerful fliers offshore; ring-billed gulls search shallower water, are on the wing more, and range inland fresh-water lakes. Laughing gulls are strong fliers, hovering, parachuting, and picking from the surface; their breeding range lies mostly south of the herring and ring-billed gulls. Bonaparte's gulls are faster, more erratic fliers, picking small prey from the water or sitting and pecking like a chicken; they nest in trees in the forests northwest of

the breeding range of the larger gulls. The cliff-nesting Iceland, Kumlien's, and Thayer's gulls (subarctic, near relatives of ring-billed and short-billed gulls) occur in the northern part of the herring gull range, coming south in winter to the Gulf of St. Lawrence. Thayer's gulls come south to the British Columbia coast. In the far North, cliff-nesting glaucous gulls take the place of the great black-backs. Even farther north, on the arctic islands and northern Greenland, there are species such as Sabine's gull, ivory gull, and rosy gull which we seldom see.

Adaptations

Whenever there is high mortality, anything which helps in the survival of an individual is of great advantage and will be encouraged by Darwinian "natural selection". During the first days after hatching, a chick instinctively pecks at its parent's bill – especially at the red spot. This pecking stimulates the parent to regurgitate food. It is as if the adult did not know the young needs food but is "loaded" and needs to have the trigger pulled by the chick. When they start to run about, chicks do not know the borders of their parents' territory, and the adults have to guard them from neighbours who would kill the chicks if they intruded into their territories. The spots on the top and back of the chick's head identify each chick individually; the adults learn these markings in the first few days and the chicks learn the borders of the territory. These spots are the last of the downy plumage to be lost before the chick leaves the island.

When the gull population is dense, gulls will occupy all suitable places in their feeding area (as distinct from the colony). Adults on feeding areas drive away intruding gulls. If the chicks (now flying) were excluded, their survival would obviously be endangered, and they are already at a disadvantage because of inexperience. However, chicks exhibit behaviour which lessens the adults' aggressiveness in defending their territory on the feeding areas. The chicks are thus afforded opportunities to find food. The behaviour that inhibits attack by adults takes the form of hunched posture, head pumping, and shrill calls. This behaviour is carried over from the colonies, where it caused parents to feed their chicks.

All these are adaptations to reduce the mortality of chicks at the times when they are most vulnerable. Another adaptation is the spotting of the eggs to make them inconspicuous; and another the detail that an adult removes the eggshell from the nest once the young has hatched. What a subtle and inconspicuous act – perhaps one minute in the year of the adult's experience – yet selection has picked it out and maintains it. We can guess that the adaptation developed because hungry crows and other gulls are attracted to the nests by broken shells.

The adaptations developed in gulls, such as scavenging along the shore, colonial nesting, resistance to pollution, ability to withstand crowding together at concentrated food sources, and especially their opportunism, have prepared them for a maximally profitable and peaceful coexistence with man.

Reading list

- The breeding ecology of the glaucous-winged gull *Larus glaucescens* on Mandarte Island, B.C. K. Vermeer. British Columbia Provincial Museum. Occasional Papers, No. 13. 1963. 104 p.
- The gull's way. L. Darling. Wm. Morrow and Co., New York. 1965. 96 p.
- The herring gull's world. N. Tinbergen. Collins, London. 1953. 255 p.

How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Migratory Birds Convention Act and Regulations for the federal government. In practice, federal and provincial governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds

throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's National Parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a pesticide investigator, and a biometrician. The head office is in Ottawa and there are regional offices in Edmonton and Ottawa. Smaller offices are located at Fort Smith and Inuvik, Northwest Territories; Whitehorse, Yukon Territory; Vancouver, British Columbia; Calgary, Alberta; Saskatoon, Saskatchewan; Winnipeg, Manitoba; Aurora, Ontario; Ste-Foy, Quebec; Fredericton and Sackville, New Brunswick; Halifax, Nova Scotia; and St. John's, Newfoundland.

The Service administers 94 migratory bird sanctuaries throughout Canada. It is now participating with the provinces in a major program of preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program was announced on April 6, 1966, that provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province please contact your chief provincial game officer.

Additional notes

**Canadian Wildlife
Service**

**Hinterland
Who's Who**

**Government
Publications**

CA1
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Herring Gull



The seashore would not be the same without sea gulls, but to gulls the shore is just one place to make a living. They are also found beside inland lakes and rivers, on garbage dumps and golf courses, from the Atlantic provinces to British Columbia.

Throughout their wide Canadian range and in the northeastern United States, the herring gull (*Larus argentatus*) because of its large numbers, is the bird commonly called a sea gull. However, on the west coast the term applies to the closely related glaucous-winged gull (*Larus glaucescens*).

Relation to man

Gulls as scavengers can profit from the organic wastes of garbage, sewage, fertilizer, and fish waste dumped all around our prosperous communities. Because of the availability of these wastes, gulls thrive near large cities, harbours, and fishing ports, and have become a pest in some of these places.

It was not always thus. At the end of the nineteenth century, sea gulls were rare along the Atlantic coast because of persecution. In those years, many farmer-fishermen led a precarious existence on outer islands – tending gardens, fields, and flocks, and fishing with nets and lines. Any bounty from the sea was welcome, and gull eggs and young were worth considerable exertion. Then it became fashionable to use bird wings on ladies' hats, and a fee of 20 to 40 cents could be earned for each set of wings and back feathers collected for the millinery trade. With this added to the taking of eggs and young, sea-bird populations reached a low ebb.

Fewer than 4,000 pairs were counted in 1900 – all in easternmost Maine and New Brunswick. In 1965, however, censuses showed about 100,000 pairs on some 240 colonies, all along the shore from New York City to Grand Manan, New Brunswick. Censuses of gulls made on 10 bird sanctuaries on the north shore of the Gulf of

St. Lawrence showed an increase from 1,020 herring gulls in 1925 to 18,315 in 1965. Why has there been this dramatic change?

As the standard of living rose and the use of inboard engines spread, fishermen gathered into coastal villages at safe harbours, leaving the outer islands to the thunder of the surf and the cries of the sea gulls. Gulls were given protected status in 1916 by the Migratory Birds Treaty between Canada and the United States.

With their diet supplemented by garbage and fish wastes, gulls have continued to increase apace. In many places they have doubled their numbers every 15 years. Because they are attracted to metropolitan areas, they have even become a nuisance and a hazard to aircraft flying in and out of airports.

Appearance

The adult herring gull is about two feet from bill to tail and has a white head, body, and tail. Its bill is yellow with a red spot on the lower tip and its legs are flesh-coloured. Adult gulls have grey backs, and the tips of their outermost flight feathers are black with a white spot. In winter, adult heads are heavily streaked with brown. Immature birds are a mottled brown, and take four years to develop full adult plumage.

Nesting habits

Gulls nest in colonies and, once a colony is well established, they are faithful to it and reluctant to settle elsewhere. Yet as the colony grows some birds are unable to establish breeding territories. Sooner or later, these birds start to loaf on another island, near abundant food supplies. As the urge to breed grows, some start nesting – and the rush is on. In a very few years, the colony grows to capacity.

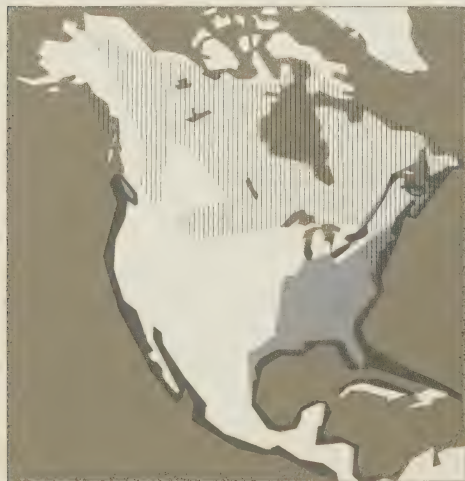
The density reached depends upon the island's terrain, not the number of gulls. Nests on a broken jumble of rocks or driftwood will regularly be 5-10 feet apart; but on grassy knobs or sand dunes, the nests will be 40-60 feet apart. Nests on an open, bald, rocky knob will be 10-30 feet apart. Thus, the characteristics of the habitat regulate how closely together gulls will crowd – a sort of zoning ordinance.

Behaviour

Although at first glance a gull colony seems a noisy, squabbling anarchy, there is a roughhewn organization. Each pair occupies an area from which they drive other gulls and on which they nest. To occupy this territory, to find and pair with a female requires communication between individual gulls. This interchange has been studied for several decades.

An early student said of birds that they have very little intellect but very intense emotions, and their communications are of moods. If a gull wants to state intent to stand fast, he gives the trumpeting "long call". If he threatens to peck

▨ Breeding
■ Winter



a neighbour, he draws himself up to look bigger, lowers his bill-tip ready to strike, and pulls his "wrists" out of his body feathers. Then he steps stiffly toward his opponent. If his opponent stands fast, both gulls are faced with the choice between attacking or running away – a conflict situation.

Many studies have been made of what birds do and why, when two moods or drives contradict each other. Does the energy of nervousness overflow and make the animal do something, or do the conflicting drives cancel each other out, hence unmasking other actions? All we can see is that when in conflict, gulls, like people, may stare at their feet or toy with a stick, just in the way that we doodle, scratch our heads, or smoke. Once an observer is familiar with what happens before and after each posture or call, he can read the moods and follow just what is going on.

Breeding

Biologically, it is most efficient for all members of a colony to get on with reproduction, so fighting during courtship is minimal and mostly bluff. By mid-May in most places, a clutch of eggs – three with nearly all experienced females – is laid and incubation starts.

In the first breeding year (third or fourth of life) many females do not lay a full clutch. Females often take every third or fourth year off from breeding, and apparently three-quarters of the females on a colony lay the full three-egg clutch.

Mortality is high. Fifty per cent of the eggs fail to hatch, or are dead or destroyed by the end of the first week after they hatch. In one study, each pair produced an average of one chick a year, ready to leave the colony at 40-60 days of age. However, about one-third of those chicks died before another month had passed.

Feeding habits

How do the gulls from a colony get all they need to sustain themselves and raise their young? In 1961 and 1962, near Boston, Massachusetts, breeding gulls were caught and coloured several bright tints to trace their daily trips for food. It was apparent that the vast majority of the gulls sought their food as close to their breeding colony as possible. If there was a fish pier within five miles, few gulls went farther. If the nearest dump was 17 miles away, commuting that far was regular; even 25 miles was not an unreasonable daily round, if there was nothing nearer and the rewards were attractive enough.

After the gulls left their islands in mid- or early August, some drifted south along the coast and a kaleidoscope of gulls was reported at loafing areas such as points on Cape Cod where gulls could go several directions to follow fishing boats. The dumps of Greater New York and resort towns of the New Jersey coast reported them too; but studies of the proportions of marked to unmarked birds made in July-August and again in

January-February showed that most of the adult gulls stayed near home. Once they have begun to breed, they apparently tend to winter next door.

We can say from these studies that a city's gull problems result from its own "effluent society". If a city cleans up its sewers and fish piers, covers its garbage and pig farms, gulls will go elsewhere. They go just as far (and no farther) as is necessary to find food, fresh water, and a peaceful place to loaf or breed.

Examination of the food in gulls' stomachs shows that they will eat almost anything – clams, small fish, floating dead animals, young and adults of other nesting birds, bread, French-fried potatoes, and so on. The majority of gulls' food is "natural", but the 20-40 per cent subsidy which they get from man's wastes has created for them a booming economy.

Related species

Of the 43 species of gull found in the world, 15 breed in Canada. Specialized feeding techniques and variation in range avoid competition between species.

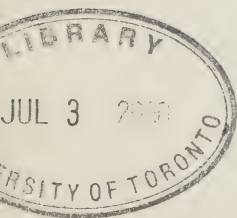
Black-backed gulls, found only on the Atlantic coast, are powerful fliers off-shore. Ring-billed gulls search shallower water, are on the wing more, and range inland fresh-water lakes. Laughing gulls are strong fliers, hovering, parachuting, and picking from the surface; their breeding range lies mostly south of the herring gulls'. Bonaparte's gulls are faster, more erratic fliers, picking small prey from the water or sitting and pecking like a chicken. They nest in trees in the forests northwest of the breeding range of the larger gulls. The cliff-nesting Iceland gull occurs in the northern part of the herring gull range, coming south in winter to the coasts of the Atlantic Provinces. Thayer's gulls nest in the Arctic and winter in coastal British Columbia. In the far North are cliff-nesting glaucous gulls. Even farther north, on the arctic islands and northern Greenland, there are species such as Sabine's gull, ivory gull, and Ross' gull which we seldom see.

Adaptations

Whenever there is high mortality, anything which helps in the survival of an individual is of great advantage and will be encouraged by Darwinian "natural selection".

During the first days after hatching, a chick instinctively pecks at its parent's bill – especially at the red spot. This pecking stimulates the parent to regurgitate food. It is as if the adult did not know the young needs food but is "loaded" and needs to have the trigger pulled by the chick.

When they start to run about, chicks do not know the borders of their parents' territory, and the adults have to guard them from neighbours who would kill the chicks if they intruded into their territories. The spots on the top and back of the chick's head identify each chick individually; the adults learn these markings in the first



few days and the chicks learn the borders of the territory. These spots are the last of the downy plumage to be lost before the chick leaves the nesting colony.

When the gull population is dense, gulls will occupy all suitable places in their feeding area (as distinct from the colony). Adults on feeding areas drive away intruding gulls. If the chicks (now flying) were excluded, their survival would obviously be endangered, and they are already at a disadvantage because of inexperience. However, chicks exhibit behaviour which lessens the adults' aggressiveness in defending their territory on the feeding areas. This behaviour, which takes the form of hunched posture, head pumping, and shrill calls, is carried over from the colonies, where it caused parents to feed their chicks.

All these behavioural adaptations reduce the mortality of chicks at the times when they are most vulnerable. Another adaptation is the spotting of the eggs to make them inconspicuous; and another the detail that an adult removes the eggshell from the nest once the young has hatched. What a subtle and inconspicuous act – perhaps one minute in the year of the adult's experience – yet selection has picked it out and maintains it. We can guess that the adaptation developed because hungry crows and other gulls are attracted to the nests by broken shells.

The adaptations developed in gulls, such as scavenging along the shore, colonial nesting, resistance to pollution, ability to withstand crowding together at concentrated food sources, and especially their opportunism, have prepared them for a maximally profitable and peaceful coexistence with man.

Reading list

- Darling, L. 1965. *The gull's way*. Wm. Morrow and Co. New York.
Godfrey, W. E. 1966. *Birds of Canada*. Queen's Printer. Ottawa.
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Tinbergen, N. 1953. *The herring gull's world*. Collins. London.

How does the Canadian Wildlife Service fit into the national wildlife picture?

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CWS studies migratory birds throughout Canada and conducts scientific research into other

wildlife problems in the Northwest Territories, the Yukon Territory and the national parks. Since the institution of the National Wildlife Policy and Program in April 1966, it has been co-operating with provincial game agencies and other organizations in research and management.

The CWS staff includes mammalogists, ornithologists, limnologists, pathologists, a biometrician and a pesticides unit. The head office is in Ottawa; regional offices are located in Edmonton and Ottawa, with smaller offices across Canada from Whitehorse, Yukon Territory, to St. John's, Newfoundland.

CWS administers over 90 migratory bird sanctuaries throughout Canada and it is participating with the provinces in a major program for preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

For further information on wildlife in your province, please contact the director of your provincial fish and wildlife department.

Written for the Canadian Wildlife Service
by William H. Drury
Photo by Cy Hampson
Issued under the authority of the Honourable
Jean Chrétien, PC, MP
Minister of Indian Affairs and Northern Development
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Catalogue No. R69-4/10
Design: Gottschalk + Ash Ltd.

Canadian Wildlife
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Hinterland Who's Who

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Herring Gull



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The seashore would not be the same without seagulls. In Canada, most seagulls are Herring Gulls, also known as *Larus argentatus*. These gulls can be quite useful, keeping our beaches clean by eating dead fish and other garbage and leading fishing boats to schools of herring, one of their favourite foods (hence the name “herring” gull). On the other hand, the gulls will steal any fish catch left untended for any length of time, and their excrement often damages the roofs of buildings where the gulls roost.

Physical description

The adult Herring Gull is about 61 cm long from the tip of its bill to the tip of its tail. Its head, body, and tail are white, its bill is yellow with a red spot on the lower tip, and its legs are pink or flesh-coloured. The backs and upper wing surfaces of adult gulls are grey, and the tips of their outermost flight feathers are black with a white spot. In winter, the heads of adult gulls are streaked with brown. Immature birds are a mottled brown and take four years to develop full adult plumage.

Range and habitat

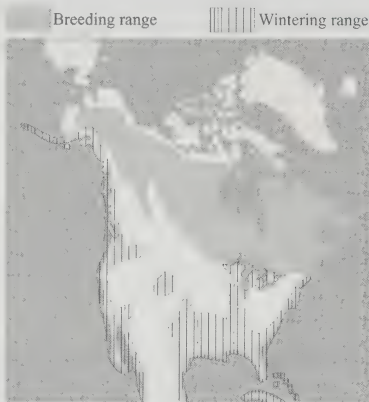
Herring Gulls are one of the most widespread species in Canada. Indeed, their breeding (summer) range includes every province and territory in Canada. Their main winter range includes the Pacific and Atlantic coasts, the southern United States, the coast of the Gulf of Mexico, and a few Caribbean islands. In the lower Great Lakes area, the species can be found year-round.

In winter, Herring Gulls are most likely to congregate on beaches along the shores of oceans and other large water bodies. In other seasons, gulls may range inland and can be found beside lakes and rivers, in grassy meadows, or on garbage dumps, golf courses, islands, cliffs, and buildings. Their main habitat requirement is a dependable source of food nearby.

Nesting habits

Herring Gulls will nest in a variety of sites, but always near a body of water. On offshore islands, they frequently occupy flat ground. On the mainland, however, they tend to nest on cliffs, probably to avoid predatory mammals. In some places where food from human activities is abundant, they have begun to nest on roofs and window ledges of buildings.

Distribution of the Herring Gull



The nest is circular and lined with moss or grass, which is also used to build up the rim. On cliffs, Herring Gulls tend to nest on turf-covered ledges.

Herring Gulls are very social birds and prefer to nest in colonies. Once a colony is well established, they are faithful to it and reluctant to settle elsewhere. In the lower Great Lakes area, for example, older, experienced breeding birds usually stay close to their colonies and are the first to reoccupy nesting territories in early spring. Some may use the same nesting site for as long as 10–20 years.

As the colony grows, some birds are unable to establish breeding territories. Sooner or later, these birds start to hang out near abundant food supplies. As the urge to breed grows, some start nesting at the new site, and the rush is on. In a very few years, the new colony may grow to capacity.

Breeding

Courtship begins as soon as birds arrive at the colony in the spring, usually mid-March. Once pairing has taken place, the birds build a nest or, more often, refurbish an old one. In most areas, a group or clutch of three eggs will be laid by mid-May, and incubation begins. Eggs are normally incubated for 26–28 days.

Females laying for the first time, usually in their third or fourth year, often lay only one or two eggs. They also tend to lay later in the season than more experienced birds, which generally make up about three-quarters of the breeding population.

Eggs are well looked after, but they can be lost. Some are eaten or stolen by other gulls, and others are washed away by

storms. Birds that lose their eggs early in the season will usually lay additional eggs to replace the ones that were lost.

The greatest losses in the colony are usually of tiny chicks in the first few days after hatching, probably as a result of predation by neighbouring gulls. Mortality among older Herring Gull chicks is mainly caused by food shortages. In one study, each pair produced an average of one chick a year, which were ready to leave the colony at 40–60 days of age. However, about one-third of those chicks died before another month had passed because they could not fend for themselves.

Behaviour

Although at first glance a Herring Gull colony may seem noisy and disorderly, there is some organization to it. Each pair occupies an area from which they drive other gulls and on which they nest.

Herring Gull communication has been studied for several decades. A gull states its intent to stand fast by giving the trumpeting “long call.” It threatens to peck a neighbour by drawing itself up to look bigger, lowering its bill tip ready to strike, and pulling its “wrists” out of its body feathers. Then it steps stiffly towards its opponent.

The Nobel Prize-winning zoologist Niko Tinbergen and his students have studied how the Herring Gull’s behaviour is related to the survival of individual birds. They have observed that the parent gulls take extremely good care of their eggs during incubation, turning them gently with their bills from time to time to ensure even development of the embryos. After hatching, the gulls immediately remove the broken eggshells, as their white inner surface might attract predators. The encounter of the bill with the jagged edge of the broken shell apparently stimulates the adult to grasp it and fly off with it. This task occupies only a minute of the adult’s time once a year, and every bird performs it.

Tinbergen also observed that the sight of the parent’s bill stimulated the newly hatched chick to peck at it. In response, the adult (whether experienced or not) regurgitated food. By using models of the adult’s head, Tinbergen showed that chicks pecked more vigorously at a bill with the normal red spot near the tip than at one without it. They also responded more vigorously to a long, thin bill than to a short one. In fact, a pencil with a red eraser on the end of it elicited the most vigorous pecking.

When they start to run about, chicks do not know the borders of their parents' territory, and the adults have to guard them against neighbours who would kill trespassers. Spots on the top and back of the chick's head identify each chick individually; the adults learn these markings in the first few days. These spots are the last of the downy plumage to be lost.

When the Herring Gull population is dense, gulls will occupy all suitable places in their feeding area (as distinct from the colony). Adults on feeding areas drive away intruding gulls. If the fledglings (young Herring Gull chicks that have just started to fly, usually at about six weeks of age), already at a disadvantage because of their inexperience, were excluded from these feeding areas, their survival would obviously be endangered. However, chicks can lessen the adults' territorial aggressiveness on the feeding areas by assuming a hunched posture, pumping their heads, and voicing shrill calls. The same behaviour causes parents to feed their chicks on the breeding colonies. Such adaptations reduce the mortality of chicks at the times when they are most vulnerable.

Feeding habits

Herring Gulls regurgitate food remains that they cannot digest. Analyses of these "pellets" and of their feces show that Herring Gulls like most other gull species will eat almost anything — clams, small fish, floating dead animals, small young and adults of other nesting birds, bread, french fries, and so on.

They have a knack for finding places where food is abundant, such as fish wharves and garbage dumps. Diet studies in the Great Lakes area showed that most pellets in colonies near large urban centres contained remains of garbage as well as various fish species. Pellets in colonies near agricultural areas often had the remains of small mammals, notably deer mice.

Individual Herring Gulls tend to specialize in particular types of food or feeding techniques. Within a large colony, some birds may regularly visit dumps, while others may feed entirely on fish and crabs found on the seashore. A few individuals take to cannibalism, watching their neighbours for an opportunity to sneak in and remove an egg or chick. These birds are often breeding birds that have lost their own brood. Although large numbers of Herring Gulls in North America are almost entirely dependent on human activities for their food, there are still populations breeding

on offshore islands or in remote parts of the low Arctic that exist on a natural diet.

How far will Herring Gulls from a colony travel in order to get all the food they need to sustain themselves and raise their young? In one study, breeding gulls were caught and coloured several bright tints so that their daily trips for food could be traced. The vast majority of the gulls sought their food as close as possible to their breeding colony. If there was a fish pier within 8 km, few gulls went farther. If the nearest dump was 27 km away, commuting that far was regular. Even 40 km was not an unreasonable daily round, if there was nothing nearer and the rewards were attractive enough.

Related species

Of the 43 species of gull found in the world, 16 have bred in Canada, but 3 have nested only occasionally. Specialized feeding techniques and different ranges prevent, or at least reduce, competition between species.

Although the Herring Gull is the most numerous of all gulls through most of its Canadian range, the closely related Glaucous-winged Gull *Larus glaucescens* is more common on the west coast. The Great Black-backed Gull *Larus marinus*, found mainly on the Atlantic coast, is a powerful flier offshore. The smaller Ring-billed Gull *Larus delawarensis* feeds more on food taken on land than does the Herring Gull and is much more abundant on the Great Lakes. Bonaparte's Gull *Larus philadelphia* is a faster, more erratic flier, picking small prey from the water or sitting and pecking like a chicken; it nests in trees in the forests northwest of the breeding range of the larger gulls. The cliff-nesting Iceland Gull *Larus glaucoideus* occurs in the northern part of the Herring Gull range, coming south in winter to the coasts of the Atlantic provinces. In the far north are cliff-nesting Glaucous Gulls *Larus hyperboreus*, and even farther north, on the Arctic islands and northern Greenland, are species such as Sabine's Gull *Xema sabini*, Ivory Gull *Pagophila eburnea*, and Ross' Gull *Rhodostethia rosea*, which southern Canadians seldom see.

Abundance

At the end of the 19th century, gulls were rare along the Atlantic coast. In those years, many farming and fishing families led difficult lives on outer islands, tending gardens, fields, and flocks and fishing with

nets and lines. Any bounty from the sea was welcome, and gull eggs and young were worth considerable exertion. Additional pressure on gull populations resulted from the millinery trade's demand for bird feathers, which were fashionable decorations on hats.

The 1900 census of the Atlantic coast showed fewer than 4000 Herring Gull pairs — all in New Brunswick and eastern Maine. In 1965, however, censuses showed about 100 000 pairs on 240 colonies along the shore from New York City to Grand Manan, New Brunswick. Since then, the Herring Gull breeding population has increased further and has expanded to include all the Maritime provinces in Atlantic Canada and the Atlantic coast of the United States from Maine to Virginia.

There are several reasons for the dramatic increase in numbers over the 20th century. As the standard of living rose and the use of inboard engines spread, families gathered into coastal villages at safe harbours, leaving the outer islands to the thunder of the surf and the cries of the seagulls. Another reason was the Migratory Birds Convention, which was signed by Canada and the United States in 1916 and which encouraged cooperation between the two countries in the protection and management of migratory birds. Most important, perhaps, was the gulls' readiness to exploit new food sources provided by human waste. In many places, these scavengers doubled their numbers every 15 years — so large an increase that they are now a nuisance in some metropolitan areas and a potential hazard to aircraft flying in and out of airports.

In Quebec, a census of Herring Gulls and other seabirds that nest in the bird sanctuaries on the North Shore of the Gulf of St. Lawrence has been carried out nearly every five years since 1925. The Herring Gull population increased from 650 to 8000 nesting pairs between 1925 and 1975, increased further to 14 000 pairs by 1988, but then decreased dramatically in most sanctuaries to about 3000 pairs in 1993. This general decline appears to be related to a decrease in the amount of fish offal, or waste, that was available to the gulls, which was the result of a decline (and total collapse in 1993) of the commercial cod fishery in the area. However, the drop in Herring Gull nesting pairs was not uniform across the bird sanctuaries.

In the freshwater environment of the Great Lakes, some 77 000 Herring Gull nests were counted (42 000 nests in the Canadian portions of the lakes and 35 000 on the U.S. side) during surveys between

1989 and 1991. When a species has a very large breeding range, like the Herring Gull does, it is likely that there will be increases and decreases in nest numbers occurring more or less simultaneously in different parts of the range. This has indeed occurred over the last few decades in the Canadian portions of the Great Lakes, and those changes are thought to be caused by local changes in food availability.

Threats to Herring Gulls

Although humans no longer kill Herring Gulls to satisfy a heavy commercial demand for their feathers, their activities still have negative effects on the birds. In the mid-1960s and early 1970s, Herring Gulls nesting on the Great Lakes were found to be experiencing reproductive failure — although there were lots of nests, there were hardly any chicks to be found. Detailed studies showed that early deaths of embryos and abnormal parental behaviour during incubation were at least partly responsible for the reproductive failure, and scientists suggested that high levels of organochlorine compounds (including polychlorinated biphenyls or PCBs, DDT-related compounds, and mirex) in both adults and eggs were to blame.

In the early 1970s, a long-term monitoring program on the Great Lakes was set up by the Canadian Wildlife Service in conjunction with the International Joint Commission to better understand the effects of prolonged exposure of bird populations to persistent toxic chemicals. Herring Gull eggs were used because the fat-soluble contaminants are transferred from the female parent to the egg yolk. The monitoring program showed that the levels of most contaminants had declined by up to 90% or more by 1995. However, lower levels of dioxins, PCBs and other related chemicals are still present in the Great Lakes due to undetected sources, atmospheric deposition, and release from contaminated bottom sediments.

Future prospects

Herring Gulls are very adaptable, in that they eat almost anything and will nest almost anywhere, both in natural areas and in the human landscape. Now that human persecution is largely a thing of the past and with contaminants at much lower levels, we may confidently expect that the Herring Gull will continue to thrive.

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- www.nmnh.si.edu/BIRDNET/ (The Ornithological Information Source presented by the Ornithological Council)

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Également disponible en français sous le titre
Le Goéland argenté.

Published by authority of the Minister of the Environment
©Minister of Public Works and Government Services
Canada, 1973, 1979, 1980, 2002
Catalogue number CW69-4/10-2002E
ISBN 0-662-31148-5
Text: William H. Drury
Photo: Hans Blokpoel
Updated by Hans Blokpoel, 2001

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**Canadian Wildlife
Service**

Hinterland Who's Who

Killdeer



This noisy and handsome bird, a member of the plover family, gets its common name, Killdeer, and its scientific name, *Charadrius vociferus*, from its call. The common name tells us what it says, and the second part of the Latin name describes its tone. The loud and almost hysterical sound of "kill-dee" or "kill-deeah" repeated frequently by both male and female is heard from early spring through summer from fields and open places.

Appearance

The Killdeer is a strikingly handsome bird. From bill-tip to tail-tip it is 23-28 cm and weighs up to 100 g. It is almost the same size as a robin, but its long legs make it appear larger. Two black bands across the white chest and an orange-coloured lower back, rump, and tail are its most distinctive markings. A white collar and white above the bill contrast with the brownish cap and the black band below the eye and around the nape of the neck. The upper back and wings are brown, but large white wing stripes are visible when the bird flies. The plumage, which is worn by male and female alike, shows no perceptible differences in summer or winter.

Adaptation

The Killdeer is admirably adapted to its life on the ground. It has a wingspread of 50 cm and is a strong and swift flier, but it can also run swiftly because it has such long legs. The broad dark bands on the breast and the alternating white and dark bands on the head make a disruptive pattern that camouflages the bird, particularly on ploughed fields and gravelly shores. The eggs also blend with their background of earth, pebbles, or stones. The bird is equipped with a long, stout bill, which can probe the earth for grubs and worms lying below the surface.

Distribution

The Killdeer is a very common bird across most of southern Canada in the summer, and nests from Newfoundland through to northern

British Columbia and up to southern Alaska. It is uncommon or absent in northern forested regions. The Killdeer also breeds throughout the continental United States to Mexico. It winters from Long Island in the east to Ohio, Colorado and southern British Columbia in the west, and south to northern South America. Although the Killdeer is classified as a shorebird, it is often found some distance from water. It frequents only open places, such as fields, pastures, and dry uplands. Golf courses and airfields, with their short grass, are also favourite habitats.

Food and feeding habits

The Killdeer's choice of food covers a wide variety of insect and other invertebrate life, much of which is injurious to agriculture. Beetles, such as clove-root and alfalfa weevils, June beetle larvae, wire-worms, the larvae of click beetles, and brown fruit beetles, compose nearly 40% of its diet. The stomachs of Killdeer taken in orchards have been found to be completely filled with weevils.

Other insects, such as grasshoppers, caterpillars, ants, bugs, caddis flies, dragon flies, and two-winged flies, make up another 40% of the diet, and other invertebrates, such as centipedes, spiders, ticks, oyster worms, earthworms, snails, crabs, and other crustacea form about 20%. Included in the Killdeer's food are many pest species. Not only are many of these harmful to crops, but some, such as mosquitoes and ticks, are injurious to people and animals. Vegetable matter, chiefly weed seeds, makes up only about 2 per cent of the total food intake.

During feeding, the Killdeer runs short distances, stops as if to listen or look, always with its head up, and then jabs suddenly at the ground. Occasionally on very muddy ground, it pats the surface with its feet as if to squeeze out some grub or worm that may be below. It may be seen feeding at almost any time of day.

Migration

Killdeer reach southern Canada as early as mid-March, about the same time as the returning robins. They travel by both day and night, and sometimes their calls may be heard overhead on moonlit nights in the spring. There is evidence that some Killdeer make the flight northward individually, particularly early in the season. It is then that a single bird will often be found where snow has melted early or where a spring or stream has kept the ground soft enough for it to probe with its bill for food. As the days pass, more Killdeer arrive. Migration is gradual and not spectacular as it is with some bird species. Some Killdeer may begin to nest in southern Canada while other migrants continue to pass through on their way further north.

In late summer, they begin gathering in flocks in fields or along shores of ponds, lakes and streams. Some of these gatherings may include only a few birds, while others may vary from 10 to 100 or more birds where feeding conditions are particularly favourable. Unlike many other shorebirds, they do not feed close

 Breeding range
 Wintering range



together, but they do form a flock when taking wing.

As autumn advances, numbers gradually decrease as birds depart for warmer places, until by late October or early November only a few remain. An occasional single bird can sometimes be found in southern Ontario in winter where a spring or stream has kept a small piece of ground soft and free of snow. Very few of these late-stayers are known to remain all winter and survive until spring.

Courtship and nesting

Because of colder weather in the more northern parts of the country, the birds arrive there late in the spring and are often already paired when they reach their nesting places. The flocks return earlier to the more southern parts, and a mate is sought after arrival. Courtship may consist of a flight high into the sky or an elaborate posturing display on the ground. In the latter case, the Killdeer crouches, leaning to one side, and drops its wings to show off the brightly coloured lower back and rump. The tail is fanned open and held high. The bird may also whirl about rapidly, again showing off its beautiful colours. While displaying in this manner on the ground, the Killdeer utters a long trilled note.

Both male and female take part in all the nesting activities. The nest is on the ground at a site that provides a good view from all sides. Fields, barren open spots, gravel bars, and closely grazed pastures (sometimes near or on dried-out cow or horse manure) are common sites. The floor of a disused quarry or a gravel roof may fill all requirements. Nests have even been found on the gravel beds of railway rights-of-way, the birds merely flying out of the way whenever a train passes.

The nest is a shallow scrape sometimes lined with pebbles, broken grass stems, and limestone or wood chips. This depression is hollowed out by the male bird, who crouches low, circling slowly as he scratches the dirt loose with his feet, throwing it out with vigorous backward kicks.

In early April in the south and later in the north, the female lays four or, very rarely, five pear-shaped eggs, which are large and blunt at one end and pointed at the other and average 36.5 by 26.5 mm in size. The eggs are pale buff, irregularly spotted, blotched, or scrawled with blackish-brown or black, and always neatly arranged in a circle with the pointed ends turned inwards. As there is more blotching on the blunt ends that face outwards, the eggs blend well with their surroundings. The female is ready to breed in her first year. There may be a second brood in latitudes where the first nesting is early. The eggs, which are rarely left unattended, can be damaged by excessive heat or cold; both the male and female take turns incubating them. On very hot days the attending bird may stand over the nest, shading the eggs with its body, at the same time allowing cooling breezes to circulate over them.

The adult birds incubate the eggs for 24 to

26 days before they are ready to hatch. A chick takes 18 to 36 hours to break out of the shell, every piece of which is removed from the vicinity of the nest by the parents within a brief time after hatching.

When the young are first hatched, they are completely covered in warm, thick down and resemble their parents, except that they have only one band, not two, across the chest. At first this down is wet, but it dries within an hour or so, and the young birds look like fluffy balls with rather long legs. Unlike the young of songbirds, shorebird young leave the nest as soon as their down has dried; they are able to feed themselves within a day, running about quickly, jabbing at the ground for small insects. The downy plumage is lost rapidly as they grow, and by midsummer they are almost indistinguishable from adults. However, head patterns are less distinct, and all browns are paler.

Although the adults do not have to feed the young, they watch them constantly and do a thorough job of brooding, guarding against enemies, and warning of danger. At the first sign of danger, the parent will give an alarm note that warns the chicks to freeze. The young will squat motionless until the parent gives an all-clear signal. Soft calls will bring the chicks running to nestle under the parent's warm feathers for a short nap or for the night. For the first few days, the chicks are brooded often to protect them from the sun or from the cold and wet. The parents cease to brood them at all after about 24 days, and after 40 days the young birds are ready to fly.

Protection of eggs and young

Killdeer are adept at distracting intruders from their nests or young. They employ one set of tactics against browsing animals that stroll unintentionally toward the nest of young and a quite different set against those that may wilfully do real harm, such as dogs, foxes, and people. An adult bird will run with outstretched wings or fly directly toward any browsing animal that appears on the verge of walking into a nest or stepping on a chick. There are recorded instances of a cow being struck on the muzzle. Once the intruder has been turned away, the Killdeer will allow it to graze peacefully nearby.

A different defence must be used against a deliberate threat, and this defence can be used by either parent. If flying around and calling loudly does not drive the intruder away, then one or the other of the parents performs a distraction display, commonly called a broken-wing act or injury feigning. The bird crouches on the ground with one wing spread and hanging as though broken. It flops about in a piteous manner, at the same time crying "kill-dee-dee-ee" as though in mortal pain. The intruder is drawn towards the seemingly wounded or helpless bird, which always manages to move away, decoying the intruder farther and farther from the nest of young birds. When the enemy is well away from its intended prey, the adult Killdeer miraculously recovers and flies off. During this display, the young will have stayed

perfectly still or will have scattered in all directions. In either case, they will be almost impossible to find.

The broken-wing act is also used to protect eggs. While the eggs are being incubated, the bird will rely on the nest never being found at all. Because the sitting Killdeer has a clear view, it can spot an animal or human being approaching long before the would-be intruder has seen it. The bird will quietly rise from the nest, walk a little distance away, and will then fly about calling loudly. As it is usually impossible to see whence the sitting bird flushed, it is difficult to locate the nest.

Relation to people

This species is entirely protected under the Migratory Birds Convention Act of 1917; it may not be hunted nor may its eggs be taken. This was not always so. From the time of the first settlers, all the shorebirds, including the Killdeer, were hunted in large numbers for food and sport. As a result, by the end of the nineteenth century, Killdeer had become very scarce, particularly along the eastern seaboard of the United States and in the province of Quebec. Now with complete protection over the whole continent, they have regained their former abundance. In fact, they may be more common now than when the continent was first settled because of the clearing of the great forests and the development of agriculture.

One of the most beautiful of shorebirds, the Killdeer is popular with bird-watchers and photographers, but it can sometimes be a nuisance to them. Always alert, it will usually be the first of a flock of shorebirds to sense an approaching naturalist and will fly away giving a loud warning cry. Away go all the shorebirds, leaving a disappointed birder or photographer. Many hunters have also blamed it for alerting ducks to their presence.

The Killdeer is useful to farmers because it has a large appetite for pests injurious to agriculture.

Limits to population

There are so many intangible factors related to the maintenance and growth of any population of birds that it becomes very difficult to determine just which are most important. Food supply, nesting habitat, predators, hazards of migration, and weather must all be taken into account. Except in extreme conditions of drought, the Killdeer, because of its varied diet, should not have much difficulty in finding a good food supply. However, these birds are severely limited in their choice of habitat by the amount of open land available for nesting. The usefulness of open fields, airfields, and golf courses is further limited by the activities that take place on them, such as cultivation. In pastures, some nests are probably destroyed every year by domestic animals that step on them, despite efforts of adult birds to avert this catastrophe. Ground-nesting birds are particularly vulnerable to predators. The eggs are in danger from rats and foxes, and the young

from cats, dogs, foxes, and hawks. Protective coloration of eggs and birds, as well as the attentiveness of the adults, gives a measure of protection.

There are always hazards during migration, but Killdeer are rarely reported in the kills that occur at towers, television masts, and light-houses. There is at least one historical account of large numbers of Killdeer having been blown off course during a severe storm.

Weather only becomes a factor if heavy spring rains wash out nests and drown very young chicks. Killdeer returning north very early in the spring might be overtaken by a late winter storm severe enough to make it impossible for them to find food and, similarly, a few may be lost every year by not returning south soon enough.

For a bird population to be healthy and stable, the same number of adult birds as there were the previous year must return in the spring ready to nest. The laying of four eggs per pair is a generous allowance to take care of the year's accidents and deaths of older birds.

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A member of the
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Published by Authority of the
Minister of the Environment
© Minister of Supply and
Services Canada, 1975, 1984, 1989
Catalogue No. CW69-4/49-1989E
ISBN: 0-662-17062-6
Text: Helen R. Quilliam
Revised by Barb Desrochers, 1988
Photo: C.G. Hampson

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IA81
-H38

Lesser Snow Goose



Each spring and fall undulating lines of brilliant white geese with black-tipped wings fly over southern Canada. The strength and beauty of these birds, as they wing their way between arctic breeding areas and temperate wintering habitat, bring pleasure to many people.

Most of the migrating white geese that are seen over southern Canada west of the province of Quebec are Lesser Snow Geese *Anser caerulescens caerulescens*, although smaller white geese, Ross' Geese *Anser rossii*, mingle with the prairie flocks. Migrating white geese seen in southern Quebec are more likely to be Greater Snow Geese *Anser caerulescens atlanticus*; however, some Lesser Snow Geese travel over the province with the flocks of greater snows and, along with them, break their migratory flights at Cap Tourmente on the St. Lawrence River. In the Atlantic provinces, migrating snow geese are seen only occasionally.

People who live in the lower mainland of British Columbia can not only see Lesser Snow Geese on migration, they can also observe the geese on their wintering grounds. This is because part of the large Lesser Snow Goose population that North America shares with eastern Asia winters in British Columbia's Fraser River delta — after breeding 4000 km away on Wrangel Island in the Soviet Arctic.

General appearance

The Lesser Snow Goose comes in two different colour phases. The plumage of white-phase geese is almost completely white, except for black wing tips. The blue-phase goose has a white head, a bluish colour on the feathers of the lower back and flanks, and a body that ranges in colour from very pale, almost white, to very dark. Both the white- and blue-phase Snow Geese frequently have rusty orange faces, because their feathers have been stained by iron in the earth where the birds feed.

The goslings of the white-phase geese are yellow, those of the blue phase nearly black. By two months of age the young birds of both colour phases are grey with black wing tips, although the immature blue-phase birds are

generally a darker grey and have some light feathers on the chin and throat, which can become stained like those of the adults. The goslings are still grey the following spring; in April and May they show white scapulars, white necks, and white secondary coverts, but they still have an overall grey wash.

By the spring the black to dark grey bills of the immature birds have become grey-pink. The bill of the adult is pink and is narrower than the broad, black bill of the Canada Goose, and it has evolved to enable the geese to eat the nutritious roots of marshland plants. The serrated edge of the bill makes the bird appear to be smiling and is sometimes called the "grinning patch."

The wingspan of the Lesser Snow Goose is about 90 cm and its average weight is 2.2–2.7 kg, the male being larger. The birds are usually seen in very large flocks and are always quite vocal. When flying they stay together in large groups but they do not generally fly in Vs like Canada Geese. Instead they form lines or Us that change shape frequently. Because of the apparent waving motion of the flying lines, snow geese are sometimes known as "wavies."

Related species

There are three kinds of white geese found in North America, the Lesser Snow Goose, Greater Snow Goose, and Ross' Goose. The Greater Snow Goose is slightly larger than the Lesser Snow Goose and nests farther north and east than the Lesser Snow Goose; blue-phase Greaters are rarely seen. The Ross' Goose is much smaller than the Lesser Snow Goose and does not have a grinning patch on the side of the bill. Blue-phase Ross' Geese are rare. As the numbers and ranges of both species have increased during the last 50 years, hybrids between them have become quite frequent. The hybrids are intermediate in size between Ross' Geese and Lesser Snow Geese.

Population size and distribution

Surprisingly, in an age of declining wildlife populations, Lesser Snow Geese have doubled in number in the past 15 years and, among North American geese, their numbers are second only to those of the Canada Goose. However, because there are many subspecies and races of Canada Geese, the Lesser Snow Goose can probably be considered the single most abundant goose in Canada. Currently, about 2 000 000 nest in Canada, along the coast of Hudson Bay, from Cape Henrietta Maria in Ontario to Keewatin; on Southampton Island; on southern Baffin Island; in northern Mackenzie and Keewatin south of Queen Maud Gulf; and on Banks Island. The other major concentration of breeding Lesser Snow Geese in the world is the one on Wrangel Island in eastern Siberia, where there are now about 100 000 birds.

Although most Lesser Snow Geese nest in Canada, only 20 000–40 000 winter in this country — in south-coastal British Columbia — and they originate on Wrangel Island. Birds nesting in the Canadian Arctic winter in central

■ Breeding areas
■ Wintering areas
■ Fall migration corridors



California, New Mexico, the interior highlands of Mexico, and along the Gulf of Mexico, both on the coast and, increasingly, in inland areas.

Migration routes

Because Lesser Snow Geese breeding in Canada are spread over such a vast area, they take many different routes between their breeding and wintering areas. Lesser Snow Geese breeding in the western Arctic form pre-migration staging flocks in the Mackenzie River delta and along the north coast of the Yukon and Alaska. On migration they fly up the Mackenzie River, through Alberta and western Saskatchewan, and on to central California or the interior of Mexico.

Birds from the eastern Arctic stage in very large numbers in James Bay and on the west coast of Hudson Bay before heading farther south. During migration they pass through Manitoba and Ontario, on a rather broad front, en route to the coast of the Gulf of Mexico.

Major shifts in autumn distribution have taken place in prairie Canada since 1975. In that year 50 000–100 000 snow geese started to use a more westerly route through eastern Saskatchewan. The shift from southwestern Manitoba to eastern Saskatchewan has continued annually to 1988. This means that birds from the central Arctic fly in two directions: one southward corridor takes them into Alberta and western Saskatchewan and another south-eastern corridor through southern Manitoba.

Birds from Wrangel Island in Siberia fly across the Bering Strait to Alaska and down the west coast of British Columbia to major wintering areas on the Fraser River, the Skagit River in Washington, and in central California. Some, also bound for California, fly up the Mackenzie River and through Alberta.

We know less about the spring migration routes, which appear to be similar to those in fall, but with some shifts between corridors. Birds returning to Wrangel Island tend to fly along the British Columbia coast, but some of the Wrangel Island population also use an interior route through Montana, Alberta, Saskatchewan, Northwest Territories, and interior Alaska. Birds of western Canadian origin wintering in California fly north through Alberta, then down the Mackenzie valley to the western Arctic coast. Birds returning from the coast of the Gulf of Mexico fly up the Mississippi and Missouri River valleys to an important staging area southwest of Winnipeg and then in a more-or-less straight northeasterly line to James Bay and the Hudson Bay coast and north into the eastern Arctic.

Breeding behaviour

Lesser Snow Geese, unlike most other waterfowl, usually nest close to each other in large colonies with densities of up to 2000 pairs per square kilometre. When snow geese first return to their breeding colony the ground is often still snow-covered. But snow geese are well adapted to wait for the thaw of ice and snow in order to nest. In spring they carry heavy loads of fat

and protein in their body reserves and can live on these for up to two weeks, though where possible they feed on emerging vegetation. As the snow begins to melt the flock breaks into smaller groups and eventually into pairs.

The nest itself consists of a scrape in the moss or gravel that often becomes built up into a mound over the years with bits of moss, willow, and grasses. Some down is added to the nest bowl as the eggs are laid. From two to six eggs are produced, with the average clutch size being around four. Incubation begins when the last egg is laid and continues for about 23 days. Only the female incubates. The male remains nearby to protect the female and nest from predators and from other geese looking for a ready-made home. The female leaves the nest for only a few minutes each day, and in the latter part of the incubation period she may not leave at all. As a result she is very thin by the time hatching begins; she may lose up to 30% of her body weight, which she regains when she starts to feed with the goslings.

Nesting starts as early in the spring as northern snow conditions allow and varies between colonies. Depending on latitude, egg-laying begins from late May to mid-June. If delayed by snow cover after 20 June, the geese do not breed; instead, they resorb their eggs and wait until the next year. Incubation starts about five or six days after the first egg is laid. The lapse of time varies according to the number of eggs produced, and peak hatching occurs between late June and mid-July, eggs in the more southern colonies generally hatching earlier than those in the north.

After hatching, the young geese must grow very quickly in order to be large enough to fly south before the Arctic winter returns. After all the young birds have hatched they may stay together in the nest for up to 24 h. When they have dried off they leave the nest, together with both parents, and begin to feed. Initially their diet consists mostly of insects, which are never scarce during summer in the Arctic. As they grow, their need for a high-protein diet diminishes, and within about two weeks they have switched almost completely to grasses and sedges. From an initial weight of about 100 g at hatch the young grow to more than 1200 g in six to seven weeks. While the young are still small both adults moult their flight feathers, the males a week or so ahead of the females. Subadults and failed breeders moult two to three weeks before successful parents. Some goslings and their parents walk and swim up to 50 km during the eight-week period from hatching to fledging. Both the young and the adults must spend most of their time feeding in order to grow large enough to fly or to regain their flight feathers by mid-August. The family group gains its power of flight at the same time.

Snow geese show a very strong family bond. The young and adults remain together throughout the winter and the spring and fall migrations. The family generally breaks up when the parents start a new nest; however, sometimes

the young of the previous year rejoin the new family.

Food habits

After the Lesser Snow Geese leave their Arctic breeding grounds they begin to make use of food sources other than grasses and sedges. On migration, pasture grasses, corn, and wheat increasingly form the main part of the diet, although birds migrating along the west coast still rely on traditional estuarine plants. During the winter on the Fraser River delta, the geese also feed on pasture grasses and fall rye. In wintering areas along the Gulf of Mexico, the birds have traditionally fed on tubers, roots, and grasses in coastal marshes; however, in about 1960, some of this wintering population began to feed farther inland on cultivated grain — both on fall-sown crops and on the waste grain left by bigger harvesting equipment. In spring, Lesser Snow Geese feed voraciously on grasses, weeds, forbs, and waste grain and put on much weight.

Because most marshland plants store their energy reserves in their roots in winter months, Lesser Snow Geese have evolved strong serrated bills to cut and tear the roots of bulrushes and sedges from the ground in coastal marshes. The goose holds the plants with the serrated edge so that its powerful, toughened tongue (also serrated along the margins) can cut through them.

Research and management

The Lesser Snow Goose is the most highly studied of the Arctic-nesting geese. Much has been learned about it, but there are still many things that are unknown. Its population has increased steadily over the last 40 years, probably for several reasons. The increase in winter food due to changing agricultural practices in the southern United States is probably the most important cause. Climatic changes in the Arctic may also have helped, earlier spring snow melt in the eastern Arctic having enabled the geese to occupy new areas on Baffin Island and on the mainland District of Keewatin. Another factor is the creation of new colonies in the eastern Arctic, which are far enough south so that breeding success is rarely prevented by persistent snow.

The increased population is creating problems both for the Lesser Snow Goose and for people. When large numbers of geese concentrate in relatively small areas, they may deplete their natural food supplies. At McConnell River, on the west coast of Hudson Bay, a colony of about 200 000 breeding geese has denuded the original nesting area of edible vegetation so that little more than bare soil remains. On some colonies, including a recently established one on Jenny Lind Island, there may be too many geese for the food resources available.

When the geese turn to agricultural crops in the south, they do not confine themselves to waste grains, but may cause damage to winter wheat and important grasslands. There is also the possibility of disease outbreaks when large

numbers of birds are confined to small areas. In several recent years epidemics of avian cholera have killed many Lesser Snow Geese at spring staging areas in the central United States and in breeding colonies on the west coast of Hudson Bay, on Banks Island, and in the central Arctic.

Because of their abundance and wide distribution in southern Canada on fall migration and in the United States in the late fall and winter, many snow geese are shot by hunters. They are an important source of food for some northern people, especially the Cree Indians living around James Bay, at times when other sources of fresh meat are scarce or inaccessible. In 1988 recreational hunters reported taking about 70 000 Lesser Snow Geese in Canada and 270 000 in the United States.

Current research includes studies of the reproductive biology of the geese; of migratory routes, their use, and the timing of migration; and of food habits and the effects the geese have on the plants that constitute their food. Waterfowl managers are primarily concerned with the numbers of Lesser Snow Geese, the quantity and quality of habitat available to them throughout their life cycle, and the proportion of the population that is shot annually by hunters. High-level photography with ground truthing is used to estimate the size of breeding colonies once every four to six years.

Efforts are continually being made to protect critical habitats. Migratory Bird Sanctuaries have been set aside in the Northwest Territories to protect nesting colonies on the Anderson River delta, Kendall Island, Banks Island, the Queen Maud Gulf, Southampton Island, Baffin Island, and the McConnell River. Wrangel Island in the USSR is also a protected area. Many snow geese also winter in wildlife sanctuaries, predominantly in the United States. However, there is one important protected wintering area in Canada. The Lesser Snow Geese from Wrangel Island are one of the most important winter users of the Alaksen National Wildlife Area, on the Fraser River delta. There a major wildlife spectacle is repeated annually, as thousands of Snow Geese return to a traditional habitat, right beside the city of Vancouver.

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The Canadian Wildlife Service

The Canadian Wildlife Service of Environment Canada handles wildlife matters that are the responsibility of the Canadian government. These include protection and management of migratory birds as well as nationally significant wildlife habitat. Other responsibilities are endangered species, control of international trade in endangered species, and research on wildlife issues of national importance. The Service co-operates with the provinces, territories, Canadian Parks Service, and other federal agencies in wildlife research and management.

For more information about the Canadian Wildlife Service or its other publications, please write to:

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Canadian Wildlife Service
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Environnement
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Service canadien
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Conservation and Protection family

Published by Authority of the
Minister of the Environment
and Services Canada, 1989
Catalogue No. 69-4/79E
ISBN 0-662-17199-3
Text: Rick McKelvey
Photo: G.W. Beyersbergen

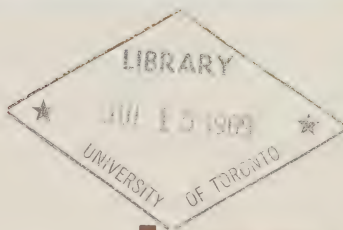
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WHO'S WHO



CANADIAN WILDLIFE SERVICE



Loons

(*Gavia*)

The loons are large water birds that are as well known for their weird voices as for their extraordinary ability to dive and swim beneath the surface. Anyone who has camped beside a northern lake in spring is familiar with their haunting calls.

Loons are long-bodied birds with short tails, thick necks, and strong dagger-like bills. Their sharp bills and their habit of swimming low down in the water will separate them from the ducks and geese. They may be distinguished from their relatives, the grebes, by their larger size, thicker necks, and sleek heads. All of the larger grebes bear crests in spring.

Four species of loons occur in Canada. Three are arctic or sub-arctic breeders and are rarely seen except on migration. The fourth, the common loon, is the one best known. Much that may be said about this bird applies equally well to the others.

The common loon (*Gavia immer*) once nested on most of our wooded lakes from New-

foundland to British Columbia. There are still resort lakes where its laughing call is a familiar sound, but it prefers solitude. Each year motor boats are driving more and more loons to remoter places.

The common loon is about the size of a small goose. It is easily recognized in spring when white marks arranged in regular lines across its black back and wings give it a finely checkered appearance. Its head and neck are glossy black. The bird carries an obvious necklace of white marks and the upper throat bears a thin line of white spots. The three-inch bill is black and the bird has red eyes. The silvery underparts are best seen when the loon stands upon the water to flap its wings, or rolls upon its side to preen. The sexes, as in all loons, are alike.

The loons are all dressed in smooth, compact plumage that is watertight. Incidentally, Indians once used loon skins for making watertight bags, and the early settlers fashioned capes and other articles of clothing from them.

The legs of loons are placed far back, and the upper joint is encased in the body. This allows them little freedom of movement on land. Loons can only waddle awkwardly in an almost upright position or shuffle forward on wings and breast. Their short wings cannot lift their heavy bodies from the ground, and the birds require a long splashing run across the water to get them into the air.

Loons may be clumsy birds on land but they are unequalled in the water. They swim rapidly with powerful thrusts of their large webbed feet. They are even more at home beneath the surface. The birds plunge forward with arched necks to dive with little disturbance of the water. They are incredibly quick to dive. Old-time hunters sometimes maintained the birds could see the flash of a gun and dive before the pellets reached them. Swift as they are, loons are hardly that fast, and many birds were undoubtedly saved by their thick, tough feathers.

The birds remain submerged for lengthy periods and at times travel long distances under water. They are extremely fast beneath the surface too. A loon may dive a hundred yards in front of a sailboat and in a few moments surface a hundred yards behind. The birds occasionally go to great depths in pursuit of fish, for loons have been caught in fish nets set sixty feet below the surface. The loons also share a habit with the grebe of slowly sinking



their bodies when alarmed until only head and neck remain above the water.

Small lakes, bordered by tamarack and spruce, are favourite breeding spots for common loons. Such lakes often teem with minnows and sticklebacks, a necessary requirement for these fish-eating birds. Loons are solitary nesters and small lakes never hold more than one pair of breeding birds. On larger lakes pairs may take over different bays, but always at some distance from one another.

Common loons arrive on their breeding lakes in May. They come in on direct flight with their short wings beating a steady stroke. In the air they appear hump-backed and pointed at each end. The head and neck are carried below the level of the back, and the large feet trail slightly downwards.

The birds meet the water breast first. They seem unable to brake when in the air and plough a long furrow in the water before they lose their momentum.

Loons soon make their presence known by their characteristic calls. The call most often heard is a laughing "ha-ha-ha-ha-ha". It has a mirthless, insane quality that has given rise to the expression, "As crazy as a loon!" A wolf-like wail is usually given at evening or at the approach of a storm. This cry is a prolonged "Who-who-who-WHO-o-o-o" rising and fall-

ing to end on tremulous notes. Sometimes a loon will give this call at dusk and then from nearby lakes or bays others will take it up. From far away the echoing cries are heard until the night is full of the birds' wild wailing.

The birds are paired when they arrive at the breeding grounds. They probably mate for life. Courting behaviour consists in part of wild races across the water. The birds tread water side by side as they make this splashing dash. Sometimes the pair will swim slowly towards each other until their bodies touch. Then both bills are pointed to the sky.

Nesting starts in early June. Nesting material is usually aquatic vegetation. The nest is often placed on the end of a point that juts into the lake. Islands are frequently used when available. Sometimes nests are built up on muskrat houses or patches of floating bog vegetation. In any event the nests are always placed where the birds may slip directly from them to the water. The same sites are often used from year to year.

Normally two eggs are laid. They are about three and one-half inches long and may vary from dark olive-green to brown. The shells have a smooth, yet granular surface and are sprinkled with dark spots. No attempt is made to cover them when the bird leaves the nest, but they blend well with the sodden, dark weeds on which they are laid.

Both birds take turns at incubating. The sitting bird is very wary and is seldom seen on the nest. Before the lake is reached the call of a loon is often heard. This is probably a warning cry, for by the time one gets to the shore both birds are usually well out on the water.

The eggs hatch in about thirty days. The young at first are covered in thick brown-black down. They leave the nest soon after hatching and can swim at once, but do not dive for several days. For the first week or two the young are frequently carried on one or other of the old birds' backs.

The baby loons are fed on small fish from the start. They grow rapidly, lose their down, and acquire gray feathers. By late September they can fly and are almost as large as their parents.

The loons do not attain full breeding plumage until their third year. The immature birds, unlike the gulls and geese, do not migrate in spring. They congregate in summer on coastal waters and do not visit their nesting grounds until they are ready to breed.

All of the loons live mainly on fish which they readily catch when swimming under water. Their large feet propel them in the depths and the wings are used only when an extra spurt is needed. An arctic loon, caught in a fish net in Alberta, was transferred to a horse trough where it fed greedily on minnows. The bird turned and twisted rapidly as it pursued the fish. Only its feet were used in the small confines of the tank. The fish were caught between the mandibles and never speared. They were swallowed under water. It is likely the common loon catches and eats its fish in the same manner.

Although fish form the largest part of the loons' food the number of clam shells found around the nests of common loons indicates that many of these fresh-water molluscs are eaten. Other small water animals are consumed and some vegetable matter is taken.

Large birds, like loons, that feed primarily on fish are often accused of depleting game-fish populations. It is likely that loons eat little but the small coarse fish. In many of their breeding lakes no others are available. In any event loons are too thinly spread to do much harm. They may do good by removing unwanted species and they are necessary checks that help to keep fish from overcrowding.

The common loon loses its breeding plumage in late summer. In winter it is a dull gray bird with a dingy white throat. Even the red eyes lose colour and become brown. At this time old and young are much alike.

The birds leave their nesting areas in October. Some remain on lakes as far north as they can find open water, but most go to sea off both our coasts.

The yellow-billed loon (*Gavia adamsii*) is almost a counterpart of the common loon, although it is usually larger. It may be distinguished only by its yellow-white bill, the lower half of which angles up. This bird breeds from Great Slave Lake northward across the Western Arctic. It winters on northern seas and is not likely to be seen in settled parts of Canada.

The arctic loon (*Gavia Arctica*) is a small loon that should be looked for in Western Canada. It is intermediate between the ducks and geese in size and is a sleek, handsome bird. The crown and hind neck are pearl-gray and the underneck and throat are black. A series of white lines streaks the sides of the upper

breast, and the underparts are silvery white. White squares arranged in lines form four obvious patterns on the back of wings and upper back.

This loon also breeds from Great Slave Lake north to the Arctic Coast and Islands. It was formerly known as the Pacific loon and congregates in large numbers off the West Coast in winter. In recent years numerous arctic loons have been seen on autumn migration in west-central Alberta.

The red-throated loon (*Gavia stellata*) is about the same size as the Arctic Loon. It too is a lovely bird. The head and neck are soft slate-gray and the throat bears a triangular patch of chesnut-red. The back of its neck is streaked with fine white lines. Wings and back are brownish gray with little marking. Like the rest of the loons its underparts are white.

This bird breeds across the northern parts of Canada. It takes off from water more readily than the other loons and often nests on small tundra ponds. The red-throated loon may be seen in both Eastern and Western Canada when on passage, but is more common in the Great Lakes region. It winters off both our coasts.

How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Act for the Federal Government. In practice, Federal and Provincial Governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's National Parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a pesticide investigator, and a biometrician. Offices are located at Fort Smith and Inuvik, Northwest Territories; Whitehorse, Yukon Territory; Vancouver, British Columbia; Calgary and Edmonton, Alberta; Saskatoon, Saskatchewan; Winnipeg, Manitoba; Aurora, Ontario; Ottawa, Ontario; Ste. Foy, Quebec; Fredericton and Sackville, New Brunswick; Halifax, Nova Scotia; St. John's, Newfoundland.

The Service administers 93 migratory bird sanctuaries throughout Canada. It is now participating with the provinces in a major program of preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding, and resting on migration.

A National Wildlife Policy and Program was announced on April 6, 1966, that provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province please contact your chief provincial game officer.

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Mallard



The handsome mallard (*Anas platyrhynchos*) is probably the best known wild duck in the world. It is widely distributed throughout North America, Europe, and Asia and has been introduced to many other parts of the globe. Even in the hearts of many major cities, half-tame mallards waddle ashore from park lakes to take food from the hands of visitors. Thousands of people who have never seen this splendid duck in the wild have admired it on these or other ornamental waters.

The mallard is found in Canada from southwestern Quebec to the Pacific Coast, but is most numerous in the Prairie Provinces. It is not one of the more northerly breeding ducks, however, and in Canada reaches the Arctic Ocean only around the Mackenzie River delta. Rare or absent in the Atlantic Provinces and Ungava, the bird is replaced there by its close relative, the black duck.

Appearance

The male mallard in breeding dress is unmistakable. The glossy head and upper neck are brilliant green, but may show purplish reflections in certain lights. The green head is separated from the rich chestnut of lower neck and breast by a white collar that is incomplete behind. The rest of the underparts and sides are light grey.

The back and wings of the bird are greyish brown, and the whitish tail has black above and below it. Two central black feathers that curve back above the tail give the breeding drake its characteristic curly-tailed appearance. The bird has a yellow bill and orange legs and feet.

A distinguishing mark in the plumage is the purplish-blue speculum or window patch, carried at the back of the inner portion of the wing. It is visible when the duck is in flight. Bordered in front and behind by faint bars of black and conspicuous ones of white, the speculum is unlike that of any other duck. The white bars will separate the mallard from the darker plumaged black duck, whose similar blue patch lacks these markings.

The female mallard is a much less colourful bird. Its back is mottled brown, its breast heavily streaked with buff and darker brown. It is best recognized by the bordered speculum, which is similar to that of the male. The bird has a greenish-yellow bill, sometimes blotched with black, and its legs and feet are orange. The white wing linings and the whitish outer edges of the tail are seen when the duck is in flight. In the mating season it is readily identified by the male companion. It is the noisiest of the pair and its loud "quack-quack" is similar to that given by farmyard ducks. The note of the male is a higher pitched "queek".

"Dabblers" and "divers"

If a gathering of ducks is watched on a lake or pond, some birds will be seen dabbling on the surface, or tipping bottoms-up to reach food just below it. Others frequently submerge to get food in the depths. The ducks are divided into two main groups according to these feeding habits.

The mallard is a typical member of the surface feeding group, known as the dabblers. It is often seen in the tipped-up position with its tail held vertical. Although the bird can dive in an emergency, it rarely does so.

The legs of the mallard and other surface-feeding ducks are placed near the centre of the body, enabling them to spring straight up when they rise from water. This also gives them good balance on land, where they walk well with their characteristic waddle.

Diving ducks, whose legs are farther back, are awkward birds on land. On the water, most require a pattering run across the surface to get them air-borne.

Food

The food of the mallard is largely vegetable material procured in the water or on the land. In the water, the bird feeds on emergent weeds and the tuberose roots of plants that grow in shallows. On land it turns to grain, other seeds, and green stuff. Animal matter is also taken. This is made up of molluscs, small crustaceans, and insects and their larvae. The mallard is credited with destroying quantities of developing mosquitoes.

Life history

Mallards are hardy ducks, wintering regularly in southern Ontario and southern British Columbia. Some will remain as far north as they can find open water. Even in Alaska, some birds are found throughout the colder months, and in Alberta mallards stay on the open waters of the North Saskatchewan as far north as Edmonton.

The great majority, however, migrate to the central and southern United States, where lakes and ponds are ice-free throughout the year. The mallards are essentially fresh-water ducks, although some may winter on coastal bays.

Mallards are one of the first ducks to arrive

A Breeding range
B Wintering range



back on the breeding grounds in spring. They are adaptable and may nest near a lake, pond, river, or even woodland pool. Their preferred habitats, however, are the little reed-ringed sloughs and potholes which are so numerous in the wetlands of the prairies.

By late March or early April, the first of the mallards are back on the prairies. At this time, lakes and ponds are usually frozen and only melt-water fills the hollows of pasture lands and fields. The early arrivals are usually mated pairs, and for a few days the birds gather around the melt pools and seek waste grain in stubble.

As leads open in lakes and sloughs, more birds pour in and, among these, some are unattached. Now courting takes place. Three or more males may attend a female as she swims. The males sidle toward the female with heads bobbing. As they jerk up their heads, water sprays from their yellow bills. Occasionally, a male may rear itself to display its chestnut breast. These activities may be interrupted as the female leaps into flight. Now a wild chase ensues. Twisting and turning, the female leads her suitors, while each male tries to fly closest to her. An ardent male may try to grab her with his bill. Back on the water, a male is sooner or later accepted, and most displays are ended for the pair.

The female, accompanied by the male, now searches for a territory. With mated pairs the female invariably leads the flight. The territory of a duck, unlike that of a songbird, does not necessarily include the nesting site. It is an area of water with a shoreline, sandbar, or even floating log, where the birds may loaf or preen. It may be an area of lake or river, but is more often a pond or pothole fringed with cattails. Here copulation takes place, and here the male may await the female while she is laying. The birds find most of their food on the territory at this time. Although the female selects the territory, the male defends it from all other mallards.

The female chooses the nesting site. It may be close by the pond, but is frequently at some distance and may be far from water. Woodland mallards sometimes nest in trees using the old nests of crows, or other large birds, but these are most unusual sites.

Normally on the ground, the nest is little more than a depression lined with bits of rushes, grass, weeds, or other material close at hand. It is usually in good cover such as thick grass, or under a buckbrush, rose brier, or other prairie shrub. The eggs, which with different birds may vary in colour from dull green to almost white, are laid daily. Up to 15 may be deposited, but the usual number is between 8 and 12.

Incubation does not start until the last of the eggs has been laid. This ensures that all the ducklings will hatch at approximately the same time.

During the laying period, and particularly in the early stages of incubation, the female sheds

down from her belly to line the nest. This grey down, with white centres, is pulled over the eggs when the duck is off to feed. It not only supplies warmth but hides the eggs from marauding crows, magpies, and other predators, which are quick to find uncovered eggs.

The female does all the incubating, which takes around 28 days. The ducklings emerge as handsome little balls of down. Their clove-brown backs are relieved by four yellow patches. Faces and underparts are also yellow, with the exception of a dark ear spot and a brown line through the eye.

As soon as the ducklings are dry, the female leads them to the nearest water. This may be long and hazardous journey. Although the female may have nested near a pothole or slough full of spring melt-water, much of this water may have evaporated, leaving nothing but drying mud. On overland trips, straggling ducklings may get lost in the grass, or be picked up by predators.

The mallard is an excellent mother, however. She will stop at frequent intervals to collect and brood her young. If surprised by man or beast, she is likely to go flapping and squawking across the ground, as if injured. This feigned injury may not fool a man, but undoubtedly lures predators away.

Once on the water, the female leads her brood to feeding areas. The young find their own food, which at first probably consists of small crustaceans, such as water fleas, insects, and tiny plants like duckweed. Here the female displays the same anxiety for her young. If molested, she will flap awkwardly away, while the ducklings patter for the shelter of the reeds.

The young gradually lose their down and grow their feathers. In about 10 weeks they have assumed a plumage that is much like that of the female. By that time, the female has abandoned them.

After the breeding season mallards moult into what is known as an eclipse plumage. The males are the first to undergo this moult.

The males remain on their territories for about the first 10 days of incubation. After that, they desert both the territories and their mates. For a time they gather together, and then retire to one of the larger bodies of water. Here they lose their brilliant breeding plumage. Their green heads, white collars, and chestnut breasts disappear. Even their bills lose the bright yellow. All their flight feathers are shed at once, and for about a month the birds are flightless. They skulk in the reeds until their new feathers are grown.

Their new plumage is comparatively drab and difficult to distinguish from that of the female. Not until late fall do they regain their bright colours, which they carry throughout the winter.

When the females have left their broods, they too gather in the reeds to moult. They also

become flightless, but the new plumage they assume is little different from the one they have shed. In the late fall the young gain the plumage of their respective sexes. The males, however, may not attain their full brilliance until their second year.

In late summer the birds gather in mixed flocks of young and old. Throughout much of the day they sit and loaf far from shore. As the grain ripens, the ducks make their flights to the feeding fields.

These flights are usually made in early morning and late evening, but in dull, stormy weather may occur throughout the day. They provide the western sportsman with his best duck shooting.

Management

The mallard is famed as a game bird throughout its range. Fast on the wing, it decoys readily and its flesh is of excellent quality. Large male mallards may weigh well over 3 pounds, but the average weight is around 2¾ pounds.

No duck is more extensively hunted. In spite of low bag limits, an estimated 360,000 mallards were shot in Alberta alone in 1967.

Although the mallard is one of the hardiest and most adaptable of ducks, its numbers have been greatly reduced in recent years. Hunting pressures have taken their toll, and drainage of wetlands has destroyed much of its habitat. The Canadian Wildlife Service has leased many marshes and potholes in an attempt to protect and restore this, and other, ducks.

Mallards are one of the few ducks that habitually feed on grain. Barley and wheat are preferred. Most grain is now harvested by combine, but when inclement weather forces the grain to be left in stook or swathe, the ducks may do much damage. Great quantities are eaten by the large flocks and much is trampled out by the birds' big feet. Attempts are now being made to grow buffer grains where mallards are numerous, to entice the birds from farmers' crops.

Throughout the ages, the mallard has benefitted man by supplying him with eggs and flesh. It has long been domesticated, and many strains of our domestic ducks show their mallard ancestry in their bright colours.

Apart from its usefulness, the mallard is a beautiful bird that brings delight to many outdoor people. The bird watcher knows of few more thrilling sights than mallards dropping down with feet out-thrust to find the first spring water.

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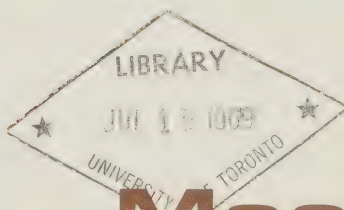
Written for the Canadian Wildlife Service
by Robert Lister. Photo by Cy Hampson.

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WHO'S WHO



Moose

(*Alces alces*)

Canada's timberlands extend from the Alaska boundary to the eastern tip of Newfoundland. All regions of this vast and varied tract have one thing in common: they all contain moose pasture.

Moose are found on the rocky, wooded hill-sides of the western mountain ranges; along the margins of half a million lakes, muskegs and streams of the great Boreal Forest; and even on the northern tundra.

No one knows accurately how many moose there are in Canada, but there are probably well above half a million. The moose is a big-game animal prized by the sport hunter, but he is much more than that. To the Indian hunter of the North, the moose is an essential source of food, and is hardly less essential to bears and wolves and to the many scavengers that feed on carcasses.

The moose is the largest member of the deer family—whose North American members also include elk (wapiti), white-tailed deer, mule deer, and caribou. Seven distinct races of



Canada

CANADIAN WILDLIFE SERVICE

moose are found throughout the great Boreal Forest that circles the northern part of the globe. These are the European elk, the Siberian elk, the Manchurian elk, the Yellowstone moose, the northwestern moose, the eastern moose, and the Alaskan moose—the largest of all these very similar races. (In Europe and Asia the moose is commonly called “elk”.)

General appearance

A bull moose in full spread of antlers is the most imposing beast in North America. It stands taller at the shoulder than the largest saddle horse. Big bulls weigh as much as a horse—up to 1,800 pounds.

The legs of the moose are long and slim, and end in cloven hooves which are often more than seven inches long. The front legs are very long, and the body is deep at the shoulders, so the animal has a humped appearance. It is slab-sided and low-rumped, with rather slim hindquarters and a short, well-haired stubby tail. The neck is short, the head is heavy and compact, and the nose extends in a long, mournful-looking arch terminating in a long, flexible upper lip. The ears are similar to those of a mule, although not quite as long. From the throat of most moose hangs a pendant of fur-covered skin, perhaps a foot long, called a bell.

In colour the moose varies from dark brown, almost black, to reddish or greyish brown, with grey or white leg “stockings”.

In season a mature bull carries a great mahogany-coloured rack of antlers which may extend six feet or more between the widest tips, but which are more often four or five feet in span. The heavy main beams broaden into large palms which are fringed with a series of spikes usually less than a foot long.

Life history

At birth a calf moose is a tiny, ungainly copy of its mother. If it is one of twins it may weigh 13 or 14 pounds; if born singly, between 25 and 35 pounds.

The calf is helpless at birth, and is kept in seclusion for a couple of days, hidden from its many enemies in a thicket or on an island. The voice of a newborn calf is a low grunt, but after a few days it develops a strident wail that is almost human. At the age of only a few days it can outrun a man, and swim readily.

Of all North American big-game animals, the moose calf gains weight fastest. During the



first month after birth it may gain a pound or even two pounds per day, and later in the summer may begin to put on as much as five pounds per day for a time.

Calves stay with the cow for a full year—sometimes longer.

A bull calf may develop button antlers during its first year. New antlers are grown each summer and shed each autumn. Mature animals usually shed their antlers in November, but younger bulls may carry theirs until December. Yearling bulls usually have spike antlers, and the antlers of two-year-olds are larger, usually flat at the ends and sometimes palmate. Thereafter the racks are large and palmate.

The antlers begin growing in midsummer and during the period of growth are soft and spongy, with blood vessels running through them. They are covered with a velvety skin. By late August or early September the antlers are fully developed and are hard and bony. The velvet dries and the bulls rub it off against tree trunks.

Feeding habits

The moose lives almost solely on twigs and shrubs during the winter months. In summer this diet is varied with leaves, some upland plants, and water plants in great quantity. An adult moose eats 40 to 50 pounds of twigs each day in winter, and in summer eats 50 to 60 pounds of forage—twigs, leaves, shrubs, upland plants, and water plants.

Winter forage includes twigs of balsam fir, poplar, red osier dogwood, birch, alder, and several other trees and shrubs. In the Atlantic

Provinces striped maple (moose maple) is a favourite food. When food becomes scarce, as it often does toward spring, they will strip bark from trees. In summer, especially when the fly season is in progress, moose take to the water for several hours each day. They dip their heads under the surface for water lilies and other water plants. Moose tend to gather around salt licks, usually low-lying areas of stagnant, mineral-rich water.

Adaptation to environment

The moose is extremely well-adapted to rough country. Its legs are long enough to carry it easily over deadfall trees or through snow that would stop a deer or wolf. Its cloven hooves spread widely to provide support when it wades through muskeg or over soft surfaces. The dew-claws, located to the rear below the fetlock joint, provide additional support. With its tremendous physical power and vitality, the moose can travel over almost any terrain. When frightened it may crash noisily through the underbrush, but in spite of its great size even a full-grown, antlered bull can move almost as silently as a cat through even dense forest.

Moose are quite at home in the water. They sometimes dive 18 feet or more for palatable plants growing on a lake or pond bottom. Moose have been known to swim 12 miles. Of all North American deer only the caribou is a more powerful swimmer. A moose calf is able to follow its mother on a long swim even while very young, occasionally resting its muzzle on the cow's back for support.

The eyesight of the moose is extremely poor, but its senses of smell and hearing compensate for this. Before bedding down, a moose usually travels upwind for a time, and then swings back in a partial circle. Thus any hunter on its track will have to approach from windward. Skilled hunters know when to leave the track and work their way upwind to the hiding-place of their quarry.

Sportsmen may stalk moose, or may call them during the breeding season. A skillful hunter, imitating the cow's call, usually with the aid of a birchbark horn, can entice a bull within shooting distance. When the snow is deep enough, an Indian hunter may use the more direct method of "running him down"—keeping the animal on the move until it is exhausted.

Breeding habits

Moose are sometimes polygamous, but more usually a bull stays with a given cow during most of the breeding season. The breeding season, or rut, begins in mid-September, and the listener in moose country may hear the nasal-toned bawling of the cow moose enticing a mate, and the coughing bellow of the responding bull.

Usually not more than 40 per cent of the cows become pregnant. Of these, a quarter or less produce twins and a few produce triplets. A good food supply improves breeding success.

Enemies and hazards

Black bears have been known to kill adult moose, and the grizzly bear is easily able to do so, but the main victims are calves. From birth, usually in May, until mid-August when they can outrun a bear, the calves are preyed on heavily by black bears.

Wolves seldom kill moose in summer. In winter, wolves usually hunt in packs, and in deep crusted snow, or on smooth ice, a pack can bring down a moose. They usually run up beside their quarry and rip the tender flanks until the moose is weakened from loss of blood.

Wolverine and cougar prey on calves to some extent.

Deer, snowshoe rabbits (varying hares), and even beaver compete with the moose for food. Ticks are common on moose, especially in late winter, and may weaken animals seriously. Internal parasites such as the hydatid—a tiny tapeworm—affect moose, especially when lack of forage and heavy tick infestation lower their resistance.

Low food supply is the major hazard faced by moose. A normal population in a forest region is one moose per square mile—or at the most two per square mile. But in some areas there are not enough wolves, bears, and human hunters to keep the population down. Numbers may then rise well above two moose per square mile. The usual result is starvation, or, more likely, malnutrition and consequent lack of resistance to predators and disease.

Winter is the time of starvation. Moose tend to drift to the willow-rich valleys or other good forage areas. Concentrations of up to 35 animals per square mile have been seen in Wells Grey Provincial Park in British Columbia. Under conditions like this mass starvation is

inevitable, and food supplies are damaged for many years.

Changes due to humans

Since the beginning of settlement in Canada there have been considerable shifts in moose populations. Moose are now seldom seen in well-populated farming areas, but they are found in many regions which had no moose in pre-settlement days. In many areas, forest fires and lumbering operations have replaced mature timber with small trees and shrubs, creating conditions suitable for moose. There are now large moose populations in north-central Ontario, and in the southern part of British Columbia, where moose were previously unknown. They have only recently spread into Quebec north of the St. Lawrence River. The island of Newfoundland, which had never been occupied by moose within recorded history, was "seeded" with a few pair, and now has large populations. Moose are constantly spreading northward through the sparse transition forest that extends to the open tundra. The northern limit of their range is now probably 200 miles farther north than it was a century ago. This may be due to the gradually rising temperatures of the northern regions, or in part to the high populations that have built up in many forest regions to the south, causing moose to wander farther north in search of food supplies.

Management of moose

The main problem in keeping moose populations large and healthy is basically the same problem that faces any farmer or rancher. The population must not be allowed to rise to the point where food supplies become inadequate. Moose must be thinned out by human hunters or by predators, or they will inevitably starve in large numbers. And before they die they will do great harm to small saplings and other vegetation. Timber operators in areas that are over-populated by moose find that regeneration of forest trees is harmed significantly. This may be very costly in terms of future lumber crops.

Unfortunately, there may be public objection to what seems to be heavy hunting, even in areas where it is needed. And useful predators like wolves and bears are often killed in great numbers, with full public support. Moose in many regions will be kept from starvation only

if most Canadians understand that population control is essential for the health of the species.

How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Act for the Federal Government. In practice, Federal and Provincial Governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's National Parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a pesticide investigator, and a biometrician. Offices are located at Fort Smith and Inuvik, Northwest Territories; Whitehorse, Yukon Territory; Vancouver, British Columbia; Calgary and Edmonton, Alberta; Saskatoon, Saskatchewan; Winnipeg, Manitoba; Aurora, Ontario; Ottawa, Ontario; Ste. Foy, Quebec; Fredericton and Sackville, New Brunswick; Halifax, Nova Scotia; St. John's, Newfoundland.

A National Wildlife Policy and Program was announced on April 6, 1966, that provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province please contact your chief provincial game officer.

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Moose



Canada's timberlands extend from the Alaska boundary to the eastern tip of Newfoundland. All regions of this vast and varied tract have one thing in common: they all contain moose pasture.

Moose are found on the rocky, wooded hill-sides of the western mountain ranges; along the margins of half a million lakes, muskegs and streams of the great boreal forest; and even on the northern tundra.

No one knows accurately how many moose there are in Canada, but there are probably well above half a million. The moose as a big-game animal is prized by the sport hunter. But it is much more than that to the Indian hunter of the North, for whom the moose is an essential source of food. And it is hardly less essential to bears and wolves and to the many scavengers that feed on carcasses.

The moose is the largest member of the deer family — whose North American members also include elk (wapiti), white-tailed deer, mule deer, and caribou.

General appearance

A bull moose in full spread of antlers is the most imposing beast in North America. It stands taller at the shoulder than the largest saddle horse. Big bulls weigh as much as a horse — up to 1,800 pounds.

The legs of the moose are long and slim, and end in cloven hooves which are often more than seven inches long. The front legs are very long, and the body is deep at the shoulders, so the animal has a humped appearance. It is slab-sided and low-rumped, with rather slim hindquarters and a short, well-haired stubby tail. The neck is short, the head is heavy and compact, and the nose extends in a long, mournful-looking arch terminating in a long, flexible upper lip. The ears are similar to those of a mule, although not quite as long. From the throat of most moose hangs a pendant of fur-covered skin, perhaps a foot long, called a bell.



In colour the moose varies from dark brown, almost black, to reddish or greyish brown, with grey or white leg "stockings".

In season a mature bull carries a great mahogany-coloured rack of antlers which may extend six feet or more between the widest tips, but which are more often four or five feet in span. The heavy main beams broaden into large palms which are fringed with a series of spikes usually less than a foot long.

Life history

At birth a calf moose is a tiny, ungainly copy of its mother. If it is one of twins it may weigh 13 or 14 pounds; if born singly, between 25 and 35 pounds.

The calf is helpless at birth, and is kept in seclusion for a couple of days, hidden from its many enemies in a thicket or on an island. The voice of a newborn calf is a low grunt, but after a few days it develops a strident wail that is almost human. At the age of only a few days it can outrun a man, and swim readily.

Of all North American big-game animals, the moose calf gains weight fastest. During the first month after birth it may gain a pound or even two pounds per day, and later in the summer may begin to put on as much as five pounds per day for a time.

Calves stay with the cow for a full year — sometimes longer.

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The antlers begin growing in midsummer and during the period of growth are soft and spongy, with blood vessels running through them. They are covered with a velvety skin. By late August or early September the antlers are fully developed and are hard and bony. The velvet dries and the bulls rub it off against tree trunks.

Feeding habits

The moose lives almost solely on twigs and shrubs during the winter months. In summer this diet is varied with leaves, some upland plants, and water plants in great quantity. An adult moose eats 40 to 50 pounds of twigs each day in winter, and in summer eats 50 to 60 pounds of forage — twigs, leaves, shrubs, upland plants, and water plants.

Winter forage includes twigs of balsam fir, poplar, red osier dogwood, birch, alder, and several other trees and shrubs. In the Atlantic Provinces striped maple (moose maple) is a favourite food. When food becomes scarce, as it often does toward spring, moose will strip bark from trees. In summer, especially when the fly season is in progress, moose take to the water for several hours each day. They dip their heads

under the surface for water lilies and other water plants. Moose tend to gather around salt licks, usually low-lying areas of stagnant, mineral-rich water.

Adaptation to environment

The moose is extremely well-adapted to rough country. Its legs are long enough to carry it easily over deadfall trees or through snow that would stop a deer or wolf. Its cloven hooves spread widely to provide support when it wades through muskeg or over soft surfaces. The dew-claws, located to the rear below the fetlock joint, provide additional support. With its tremendous physical power and vitality, the moose can travel over almost any terrain. When frightened it may crash noisily through the underbrush, but in spite of its great size even a full-grown, antlered bull can move almost as silently as a cat through dense forest.

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Hunting

The eyesight of the moose is extremely poor, but its senses of smell and hearing compensate for this. Before bedding down, a moose usually travels upwind for a time, and then swings back in a partial circle. Thus any hunter on its track will have to approach from windward. Skilled hunters know when to leave the track and work their way upwind to the hiding-place of their quarry.

Sportsmen may stalk moose, or may call them during the breeding season. A skillful hunter, imitating the cow's call, usually with the aid of a birchbark horn, can entice a bull within shooting distance.

Breeding habits

Moose sometimes take more than one mate, but usually a bull stays with a given cow during most of the breeding season. The breeding season, or rut, begins in mid-September, and the listener in moose country may hear the nasal-toned bawling of the cow moose enticing a mate, and the coughing bellow of the responding bull.

Usually not more than 50 per cent of the cows become pregnant. Of these, a quarter or less produce twins and a few produce triplets. A good food supply improves breeding success.

Enemies and hazards

Black bears have been known to kill adult moose, and the grizzly bear is easily able to do so, but the main victims are calves. From birth, usually in May, until mid-August when they can outrun a

bear, the calves are subject to heavy predation.

Wolves seldom kill moose in summer. In winter, wolves usually hunt in packs, and in deep crusted snow, or on smooth ice, a pack can bring down a moose. They usually run up beside their quarry and rip the tender flanks until the moose is weakened from loss of blood.

Wolverine and cougar prey on calves to some extent.

Deer, rabbits, and even beaver compete with the moose for food. Ticks are common on moose, especially in late winter, and may weaken animals seriously. Internal parasites such as the hydatid — a tiny tapeworm — affect moose, especially when lack of forage and heavy tick infestation lower their resistance.

Low food supply is the major hazard faced by moose. A normal population in a forest region is one moose per square mile — or at the most two per square mile. But in some areas there are not enough wolves, bears, and human hunters to keep the population down. Numbers may then rise well above two moose per square mile. The usual result is starvation, or, more likely, malnutrition and consequent lack of resistance to predators and disease.

Winter is the time of starvation. Moose tend to drift to the willow-rich valleys or other good forage areas. Concentrations of up to 35 animals per square mile have been seen in Wells Grey Provincial Park in British Columbia. Under conditions like this mass starvation is inevitable, and food supplies are damaged for many years.

Changes due to humans

Since the beginning of settlement in Canada there have been considerable shifts in moose populations. Moose are now seldom seen in well-populated farming areas, but they are found in many regions which had no moose in pre-settlement days. In many areas, forest fires and lumbering operations have replaced mature timber with small trees and shrubs, creating conditions suitable for moose. There are now large moose populations in north-central Ontario, and in the southern part of British Columbia, where moose were previously unknown. They have only recently spread into Quebec north of the St. Lawrence River. The island of Newfoundland, which had never been occupied by moose within recorded history, was "seeded" with a few pair, and now has large populations. Moose are constantly spreading northward through the sparse transition forest that extends to the open tundra. The northern limit of their range is now probably 200 miles farther north than it was a century ago. This may be due to the gradually rising temperatures of the northern regions. But the pressure of high populations may also play a part in this extension of range. In many forest regions to the south, the numbers of moose have risen, thus the animals may be forced to wander farther north in search of food.



Management of moose

The main problem in keeping moose populations large and healthy is basically the same problem that faces any farmer or rancher. The population must not be allowed to rise to the point where food supplies become inadequate. Moose must be thinned out by human hunters or by predators, or they will inevitably starve in large numbers. And before they die they will do great harm to small saplings and other vegetation. Timber operators in areas that are over-populated by moose find that regeneration of forest trees is harmed significantly. This may seriously reduce future lumber crops.

Unfortunately, there may be public objection to what seems to be heavy hunting, even in areas where it is needed. And useful predators like wolves and bears are often killed in great numbers, with full public support. Moose in many regions will be kept from starvation only if most Canadians understand that population control is essential for the health of the species.

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How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service, a branch of the Department of Indian Affairs and Northern Development, conducts wildlife research and management for the federal government. Each province controls the natural resources, including wildlife, within its boundaries. However, because of the Migratory Birds Treaty, signed in 1916 with the U.S.A., the federal government is responsible for management and protection of migratory birds. CWS administers the Migratory Birds Convention Act and Regulations but co-operates with provincial governments in doing so.

CWS studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory and the national parks. Since the institution of the National Wildlife Policy and Program in April 1966, it has been co-operating with provincial game agencies and other organizations in research and management.

The CWS staff includes mammalogists, ornithologists, limnologists, pathologists, a biometrician and a pesticides unit. The head office is in Ottawa; regional offices are located in Edmonton

and Ottawa, with smaller offices across Canada, from Whitehorse, Yukon Territory, to St. John's, Newfoundland.

CWS administers over 90 migratory bird sanctuaries throughout Canada and it is participating with the provinces in a major program for preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

For further information on wildlife in your province, please contact the director of your provincial fish and wildlife department.

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Mountain Sheep



Few animals are so well adapted to extremes of elevation and temperature as the magnificent wild sheep of western North America's mountain rangelands. Their range extends from the snow-fields of the Canadian Rockies to below sea level, on the desert floor of Death Valley, California, and from Alaska all the way to northern Mexico.

The wild, or mountain, sheep is a stocky, hoofed mammal, about one and one-half times as large as a domestic sheep. The most distinctive characteristic of the males is their massive horns which spiral back, out, and then forward, in an arc. Adult females have slightly curved horns about a foot long.

The wild sheep was mentioned as early as 1540 by the Spanish explorer Coronado, who saw them in the vicinity of California. He described them as "Sheep as big as a Horse, with very large horns and little tails. I have seen some of their horns, the size of which was something to marvel at."

It was the intrepid geographer David Thompson and his companion, Duncan McGillivray, who collected and preserved the first specimen of our native bighorn in 1780, near the remote upper reaches of the Bow River, just east of what is now Banff National Park.

In the years that followed, the North American wild sheep became known the world round as one of the finest and most coveted of big game trophies. Their inaccessible habitat and their alertness and speed gave any hunter who bagged one a genuine feeling of achievement.

Origin and distribution

North American wild sheep are related both to domestic sheep (*Ovis aries*), which were imported from Europe by early settlers, and to the native sheep of Asia. It is thought that about half a million years ago a primitive sheep similar to the present-day Marco Polo sheep of central Asia migrated into North America via the Bering land

bridge, which formerly connected the regions now known as Russia and Alaska.

When the great glaciers of the ice age inched south from polar centres, those animals became isolated in two ice-free areas, or refugia, one in central Alaska and the other south of the Columbia and Snake Rivers, in the United States. Sheep in the Alaska refugium evolved into the slender-horned Dall sheep (*Ovis dalli*), those farther south into the heavy-horned Rocky Mountain and desert bighorns (*Ovis canadensis*).

As the ice sheet retreated 10 or 20 thousand years ago, the northern sheep expanded their range east to the Mackenzie Mountains and south to the Peace River of northern British Columbia. Gradually two subspecies, or races, evolved. The white Dall sheep ranges across Alaska into the Yukon Territory and the western edge of Mackenzie District. Its almost black cousin, the Stone, or black Dall sheep, makes its home in northern British Columbia and southern Yukon. In the Pelly Mountain area of the Yukon, black and white Dall sheep merge gradually with each other. The curious result, known as the Fannin, or saddle-backed, sheep, has a white head, neck, and rump, but a grey body.

The southern sheep evolved into seven races, two of which returned to Canada after the retreat of the glaciers. Rocky Mountain bighorns moved north into the Rockies of British Columbia and Alberta until just south of the Peace River. California bighorns expanded into southwestern British Columbia, colonizing the arid mountains and river valleys of the Okanagan and Chilcotin areas. Rocky Mountain and California bighorns are similar in appearance to Dall sheep, except that their coat is usually brown or grey in tone. They both have a white rump patch.

Physical characteristics

Fully adult Rocky Mountain bighorn rams stand about 40 inches at the shoulder and weigh up to 300 pounds, or slightly more when they are in prime physical condition, in the autumn. Average spring weight of adult ewes is about 225 pounds, of adult ewes about 155 pounds. Dall and Stone sheep are somewhat smaller, adult males averaging less than 200 pounds and adult ewes about 125 pounds.

The front hoofs of mountain sheep are slightly larger than the hind, but both leave a print which is almost rectangular. A hard rim around the outer edge of each hoof surrounds a softer, concave (curving in) area in the middle, giving excellent traction on rocky terrain.

Mountain sheep are very agile, being second only to mountain goats in the steepness of terrain they can climb. However, the goat is more of a climber or "walker", while the sheep, which bounds like a mule deer, can move much faster.

Horns of Rocky Mountain bighorn sheep measure up to 49 inches in length and 18 inches in circumference at the base. They normally form a



tight curl close to the face and are often blunt at the tips. Dall and Stone sheep horns are more slender and widely flaring, and usually pointed at the tips. Maximum horn length in Dall sheep is 52 inches; maximum circumference at the base is 15 inches. The two horns of a male, with their cores, may weigh over 30 pounds.

These horns grow from the skin over a conical bony core and are never shed. They grow throughout life, producing a prominent check line, or annulus, each winter when growth slows. This gives biologists a convenient means of telling age.

Mountain sheep have eight sharp teeth at the front of the mouth. These are called incisors and are used to cut off plants. Their remaining teeth (molars and premolars) are deep-rooted, and adapted for chewing. All the teeth are gradually worn down by the grit which the sheep picks up as it feeds.

The pelage, or coat, of wild sheep is short and coarse, never fine and woolly, as in domestic sheep. In late summer and fall, bighorn sheep, particularly the rams, are beautifully clothed in a rich brown coat with white muzzle, white rump patch, and white trim outlining the back of all four legs. By spring, the brown coat has faded, owing to breakage of the brittle hair tips, to a drab grey-brown. Once a year, usually about June or July in southern Canada, sheep shed their hair, and until the new coat grows in, they have a scruffy, bedraggled appearance, with patches of matted old hair hanging loosely about them.

Voice and senses

The voice of the ewe is a guttural "baa", most often heard when the lambs are young; it is believed to serve as a warning of danger. Lambs make a bleating sound similar to the young of domestic sheep. The only common sound of rams is a nasal snort, usually made as a warning and when rams prepare to fight.

Mountain sheep rely on extremely acute eyesight. Slight movements and small objects can be detected up to a mile or more away. Since on the open mountain expanses an enemy cannot easily approach them unseen, they have little need for highly developed senses of hearing or smell.

Life history

In Canada, lambs are born between early May and mid-June. Normally one lamb is born per ewe, although twins occur occasionally. Ewes retire from their flock to a secluded gully or canyon to have their lamb, which can readily follow the ewe after two or three days. Sheep are sociable, and the ewe quickly rejoins her flock of 10 or more ewes, lambs, yearlings, and immature rams.

Lambs suckle the ewes' rich milk frequently at first, but begin nibbling tender plants at about two weeks of age, and are weaned at about five or six months. They grow rapidly from 10 pounds when born to about 75 pounds by the end of their first summer.

Lambs are very playful, and like games such as "follow the leader" and "king of the castle".

Sometimes nursery groups are formed in which one ewe watches over a group of frolicking lambs while other ewes feed.

When the lambs are a few weeks of age, the flocks migrate to higher, alpine summer ranges. There, the ewes and their followers fatten in lush green pastures amid alpine flowers, cascading waterfalls, and patches of perpetual snow. The adult rams, usually in groups of 5 to 15, spend the summer on other alpine ranges.

During the summer, rams establish an order of dominance in which rank depends on horn size. It is usually settled without serious fighting. In cases of similar horn size, however, as when strange bands meet, dominance must be settled by a fight. The victor wins the right to breed with the ewes.

A battle between two powerful, well-matched rams is an unforgettable sight. After backing off 30 or 40 feet they rush together and collide headlong. The echoing crash can often be heard a mile or more away. Luckily, a double layer of bone on the skull roof protects the antagonists from brain damage. Usually little harm results other than some splintering of the horn tips. After several bouts the rams casually separate, and it is not always apparent to the human observer which ram is victorious.

Most breeding activity, including fighting, takes place in November and December, after increasing snow has forced the sheep to descend from their summer range. As mating activity lessens, in late December and January, the rams drift away from their ewes and form bachelor groups. The winter is spent on relatively small ranges of south-facing, exposed grassland, where the sheep paw through shallow snow to find food.

Feeding habits

Grasses and similar low-growing plants are the staple food of wild sheep. Twigs of trees and shrubs, so important to deer and moose, are seldom eaten. Wheatgrass, fescues, bluegrasses, and sedges are important foods. Clover, peavine, lupines, pasture sage, dwarf willow, and cinquefoil are eaten where available. Mineral licks containing salts are eagerly sought, primarily in spring and summer.

Mortality factors

Wild sheep harbour a wide variety of parasites, but few cause any mortality. If food on winter ranges is insufficient, or winter weather is severe, the sheep may be weakened so that parasites such as lungworms, in association with pneumonia-causing bacteria, can cause epidemic die-offs, virtually wiping out entire herds. Scabies and other diseases introduced by domestic sheep can cause similar losses.

Accidental deaths from fighting, falls, avalanches, and highway traffic occur occasionally.

Predators – in particular the wolf in the north and cougar in the south – consistently take old or sick sheep, but are not a threat to population survival. By escaping on cliffs too steep for other animals, a healthy sheep can almost always elude pursuit. Predators such as coyotes, bears, lynx, bobcats, and eagles may rarely take newborn or diseased sheep.

The most serious threat to wild sheep numbers is lack of good quality winter food. While the summer pastures are almost unlimited, winter snows may force entire herds to feed on just a few acres of range. Many of those ranges must be shared with domestic sheep, cattle, horses, or wild animals such as elk. Resulting malnutrition may kill sheep directly, but more commonly makes them vulnerable to death from disease, exposure, or predation.

Conservation

There were probably over one million bighorns in North America at the start of the 19th century. The present population is about 25,000. Dall and Stone sheep numbers are not well known, but have changed little since pre-settlement times. The principal bighorn decline was from 1850 to 1900 – a result of diseases introduced by domestic sheep, loss of ranges to livestock, and excessive hunting by man.

Luckily, recent conservation measures have halted the decline and some herds are now increasing. Many bighorns are safe within National Parks and game reserves. Restrictive hunting laws and relocation of animals into formerly occupied ranges have increased numbers. As in the case of the buffalo (or bison), bighorn herds will never return to their original abundance because so much of their former range has been permanently settled or altered by man. However, it is hoped that further re-introductions, new parks and reserves, and improved livestock grazing practices will be rewarded by increased numbers of our unique and majestic bighorn.

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How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Migratory Birds Convention Act and Regulations for the federal government. In practice, federal and provincial governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's National Parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a biometrician and a pesticides unit. The head office is in Ottawa and there are regional offices in Edmonton and Ottawa. Smaller offices are located across Canada, from Whitehorse, Yukon Territory, to St. John's, Newfoundland.

The Service administers over 90 migratory bird sanctuaries throughout Canada. It is now participating with the provinces in a major program of preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program was announced on April 6, 1966, that provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province, please contact the director of your provincial fish and wildlife department.

Written for the Canadian Wildlife Service
by Donald Blood. Photo by Darrell Eagles.

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**Canadian Wildlife
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Peregrine Falcon



Renowned for its speed, grace and beauty, as well as its rapacity, the noble Peregrine Falcon (*Falco peregrinus*) has been the prized favourite of falconers for over three thousand years. Ever since the nomads of central Asia first pursued game with trained hawks and falcons, this sleek predator has been held in high esteem.

The name peregrine, from the Latin adjective *peregrinus*, means "coming from foreign parts" or "wanderer". The peregrine was so named as a result of the lengthy migrations of some populations. A North American name for the peregrine is "duck hawk". The naturalist Audubon aptly called the North American peregrine the "great-footed hawk", but this name is no longer used.

Appearance

The falcon group, with five species in Canada, is distinguished from other birds of prey by a tooth-like projection near the tip of the upper half of the bill. Generally smaller and more streamlined than the hawks, they have small heads, firm compact plumage, and long pointed wings — adaptations which allow them to fly at great speed. In flight they have quick, powerful wing strokes. Their strong, hooked bill and powerful taloned feet mark the falcons as highly specialized predators. In captivity, however, some species display a gentle disposition.

The peregrine is a sturdy crow-sized falcon. As in all falcons, the female (called the "falcon" by falconers) is larger than the male (called the "tiercel"). Adult males are 15 to 18 inches long and weigh about 1½ pounds, while females are 18 to 21 inches long and weigh about 2 pounds. The most reliable distinguishing features of the peregrine are its blackish malar stripe, or "moustache", below the eye, and its dark bluish-grey or slate coloured crown, back, and upper surface of the wings. The throat is white and the under parts are white to pinkish, with blackish-brown bars on the sides, thighs, abdomen, underwings and lower breast area.

Distribution and migration

The peregrine has a virtually worldwide distribution. Twenty-two races have been recognized in various parts of the world, including all the continents except Antarctica, and the major islands except New Zealand and Iceland. Their great powers of flight have enabled them to establish nesting populations in the Arctic, and as far south as Tasmania, South Africa and the Falkland Islands. There are many records of peregrines boarding ships far at sea. In one instance, a peregrine boarded a Dutch factory ship over 800 miles off Africa and remained for most of two days, departing when the ship was still over 600 nautical miles from South America.

There are three subspecies of peregrines in North America, Peale's (*Falco peregrinus pealei*), Anatum's (*Falco peregrinus anatum*), and Tundras (*Falco peregrinus tundrius*). Peale's are large dark birds nesting on the coast of Alaska and British Columbia, mostly resident or only slightly migratory. The Anatum's are medium-sized peregrines richly pigmented with brownish red, which often have black cheeks. They nest south of the tree line throughout the remainder of continental North America and are migratory in northern areas but winter residents farther south. The Tundras are smaller, paler on the breast and highly migratory peregrines of the Arctic. Peregrines banded in the Northwest Territories have been recovered in Argentina, and the most arctic nesters apparently leap-frog their more southern North American relatives to winter in South America.

Hunting habits

The peregrine's speed, size and dependability make it an excellent hunter. It is a relatively quiet bird to handle and its size enables it to take some of the larger birds. It feeds almost entirely on birds and, moreover, virtually always strikes them in flight.

Some birds of prey soar or hover in the sky and others have evolved short wings for quick, darting flights in forested country. But the long-winged peregrine specializes in direct pursuit in the open. It thus favours non-forested areas in which to hunt, particularly shores, marshes, river valleys, open moors or tundra. Even though its level speed of flight exceeds that of most birds, the peregrine takes advantage of height from which to launch its attack. The speed of its dives (stoops) at prey are estimated at well over 200 miles per hour.

A stooping peregrine is a hurtling wedge of streamlined feathers, its feet lying back against the tail and wings half closed. At such speeds it delivers a fierce blow to the prey with a half-closed foot, the usual method of disabling or killing medium-sized and large prey. If the quarry is too heavy to carry it is allowed to fall to the ground and the bird lands beside it to feed. It

Breeding range
F.p. Anatum
F.p. Pealei
F.p. Tundrius
Wintering range
Former breeding range





catches lighter prey in mid air or else strikes it down and then retrieves it. Small prey such as swallows or sandpipers are snatched in mid-flight with the talons. Falcons have a system of baffles in the nostrils to enable them to breathe during dives. Ancient falconers attempted, probably without much success, to judge a bird's speed by the complexity of this structure.

Despite the peregrine's reputation as a killer, its flights at intended prey are often unsuccessful. The ability of the falcon, agility of the prey and availability of escape cover affect the success of each stoop. As is usual in predator-prey relationships, the aberrant or the weaker prey individuals are singled out.

The prey species of such a cosmopolitan predator vary greatly from region to region and even from one nesting site to the next. In parts of the Queen Charlotte Islands, British Columbia, peregrines feed almost entirely on the Ancient Murrelet, a small sea-bird nesting there in countless thousands. However, in Germany 145 kinds of prey have been recorded, and in Britain, 117. In Europe the domestic pigeon is the favourite prey. The peregrine has even followed the pigeon, and perhaps the starling, into all the great cities of the world, usually in the non-breeding season. It has been recorded wintering on the towers of the City Hall in Philadelphia, the Post Office in Washington and the City Hall in Frankfurt. Its fondness for pigeons has placed the peregrine on the blacklist of racing pigeon fanciers.

Most hunting activity is around dawn and dusk. Peregrines have extremely acute eyesight, even in dim light.

Life history

The peregrine nests mostly on precipitous cliffs. In remote relatively undisturbed areas such as the Canadian Arctic, however, steep slopes, river cutbanks, and even low rocks and mounds may be used. In North America, nests occur only rarely on flat ground or in trees but such sites are commoner in other parts of the peregrine's range. In Finland, for example, there were large ground or bog nesting populations, and in Germany, large tree nesting populations. Both these populations have now almost vanished.

Peregrines are very territorial during the breeding season. Even in areas where nests are most numerous they are usually a mile, or often much farther, apart. This ensures adequate food for all nesting pairs and their offspring. The immediate nest site is defended against other peregrines, and often against eagles or ravens. An extraordinary feature of peregrines is their traditional use of certain ledges for nesting. Successive pairs have been known to nest on the island of Lundy, off the coast of Wales, since at least 1243.

Peregrines scrape a shallow hollow usually in the loose soil, sand, gravel or dead vegetation on

the cliff ledges in which they lay their eggs. No nest materials are carried to the ledge. Most cliff nests are on ledges with vegetation, and under an overhang. Sites with a generally southerly exposure are favoured. Within a breeding territory of several square miles a peregrine pair usually has several alternate nesting ledges. The number used by a pair or its successors is known to vary from one or two to seven in a 16-year period. If the nest is disturbed or robbed the adults will often re-nest in a different, usually nearby location.

A most intriguing departure from the tradition of nestings on cliffs is the peregrine's occasional use of man-made buildings. The most famous of such birds was the "Sun Life falcon", a female which appeared as a yearling in 1937 outside the twentieth floor of the Montreal headquarters of the Sun Life building. An aggressive bird who disliked any invasion of her family life, she remained for 16 breeding seasons, had 3 successive mates, and reared 21 young. Her readily observable nest site resulted in a host of admirers, considerable newspaper coverage, and a breeding record which, for a single falcon, remains unmatched in the annals of bird study.

During spring courtship rituals the male courts his larger mate with awesome aerobatics and a *wichew* call. Soon after, three or four mottled brick-red or mahogany eggs are laid, one every second day. Incubation is by both adults, begins when the last or second-to-last egg is laid, and continues for about 32 days. Renesting following loss of the first clutch (complement of eggs) is rare in the Arctic due to the short summer season, but is a regular occurrence farther south. As a result of some infertile eggs and natural losses of nestlings (eyases), the average number of young usually found in nests is 2.5 and the average number successfully gaining flight (fledgling) is about 1.5.

Peregrines become excited and some become aggressive when humans approach the nest, particularly if the young have hatched. Aggressive birds may dive within a few feet of intruders, screaming a high pitched *cack-cack-cack*. Since the calls often become more intense the nearer one gets to the nest, the peregrine may unknowingly aid rather than intimidate the hopeful nest seeker. While similar, the voices of the two sexes can be distinguished. That of the male is more wheezy and high-pitched, that of the female grating and coarser.

Newly hatched nestlings are awkward bundles of creamy white down with disproportionately large feet. At about three weeks the first juvenile feathers start to appear, and feathering is complete in about three more weeks. Thirty-five to 45 days are spent in the nest, and male young usually make their first flights a few days ahead of any females in the same clutch. Eyases are fed regularly by both parents, who pluck the feathers from the prey at a nearby plucking perch before



taking the food to the nest. When the nestlings begin to fly, the parents fly by with prey in their talons and the young attempt to snatch it from them in mid air as they pass. After several weeks of such instruction, the young begin to take some prey on their own.

The juvenile plumage is worn for a year with only slight changes due to wear and fading. Adults moult and replace the wing feathers, one at a time, during the summer. Sexual maturity is not reached until at least two years of age. Exceptional individuals have lived 18 or 20 years, but the average lifespan is probably much shorter.

Conservation

Peregrine Falcon populations have long been noted for their stability. In Great Britain for example, where a host of birdwatchers and falconers have studied them, the breeding population of some 600 pairs changed little from Elizabethan days until the 1940's. During the war peregrines were shot out in some areas to protect homing pigeons. Although these populations recovered after the war, from about 1945 onward many once vigorous peregrine populations have suffered widespread, unprecedented declines, particularly in Europe and North America. In the eastern United States, where at least 300 nests were once known, the peregrine is now extinct.

A decline of such rapidity, magnitude and distribution at first puzzled ornithologists. Direct decimation by man, such as nest robbing, trapping or shooting were ruled out as the primary cause, since falcons have been subjected to these onslaughts for hundreds of years. Research studies now strongly suggest that persistent chemical pesticides or similar industrial pollutants have been the major cause of the decline. Not only did the peregrine decline correspond closely in its timing and geographical extent with intensive post-war use of pesticides, but high residue levels were found in the falcons and their eggs. Population declines in the Northwest Territories were recorded in 1968 and 1969, and poor reproductive success (dead young in nests) was recorded in 1969 in both the Northwest Territories and Alaska. In both these areas, and on the coast of British Columbia, alarmingly high residue levels have been found. Falcons nesting in the Arctic can become contaminated on their southern wintering grounds, or by eating contaminated migrant prey in the nesting area.

Peregrines, like other predators, are at the end of a food chain. While species in this position have the advantage of few enemies and a longer than usual lifespan, there are other difficulties. Persistent pesticides become more concentrated at each link of a food chain, for example, from plants, to insect-eating birds, to raptorial birds. The falcons are thus exposed to much higher levels of pesticide residues than are normally found in their environment because their food

consists of birds that already contain pesticide concentrations. Residue levels in peregrines are further concentrated until they may be many times greater than the levels in their avian prey and hundreds of times higher than levels in their environment. At high levels these chemicals may cause reproductive failure by interfering with breeding behaviour, eggshell formation and hatching success. Thus, even though few if any peregrines are directly killed by pesticide residues, their populations may gradually dwindle away through lack of recruitment. Serious declines in numbers of the Osprey and Bald Eagle have also been attributed to side effects of pesticide residue.

Peregrine Falcons, like virtually all birds of prey, now receive legal protection in most parts of North America. In other parts of the world, however, protection is much less complete and considerable inroads are still being made by shooting adults and taking young from nests. Attempts are now being made to breed peregrines in captivity for reintroduction to the wild when residue levels have sufficiently declined to allow their survival, and to supply the falconry demand. But the success of this breeding has so far been limited.

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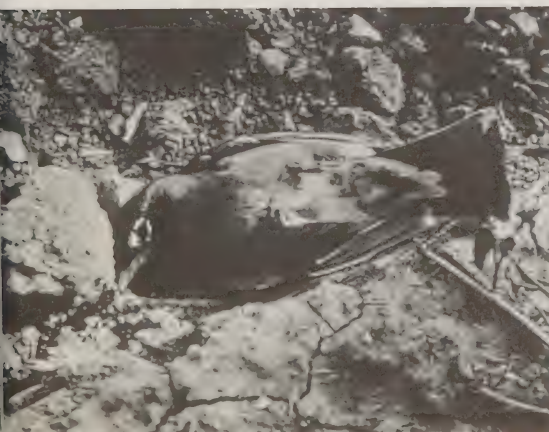
Issued under the authority of the
Honourable Jack Davis, PC, MP
Minister of the Environment
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Catalogue No. CW 69-4/32
Text: Don Blood
Photo: C. G. Hampson
Design: Gottschalk + Ash Ltd.

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Pesticides and wild birds



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Captions for cover photos

1. Pesticide spraying on farmland.
Photo: Robert McCaw
2. Swainson's Hawks that breed in Canada have died during pesticide spraying in their Argentine wintering areas.
Photo: Robert McCaw
3. American Robin killed by pesticides.
Photo: Canadian Wildlife Service
4. Endangered Burrowing Owls have abandoned their breeding colonies when pesticides were applied to nearby fields.
Photo: Canadian Wildlife Service



Are birds in trouble?

Like the proverbial canary in the coal mine, many of our bird populations are showing signs of trouble. Although a few species have clearly benefited from the human presence, those species that inhabit our farmland and other open areas are more likely than other species to be in decline. This trend is even more extreme in Europe, where the majority of common farmland birds are decreasing. The declines have been blamed not only on habitat loss, but also on agricultural intensification, in which pesticides play a key role.

Pesticides are considered by many to be essential to our everyday existence, or, at least, to our current standard of living. They have saved countless lives by reducing the impact of diseases that are transmitted by mosquitoes and other insect pests, such as typhus and malaria. They also play a major role in humankind's efforts to grow and store enough food to feed itself. The vast majority of Canadians are indirect consumers of pesticides through the food they buy. Many use pesticides directly, often without realizing it: outdoor paints and wood preservatives, disinfectants, and flea collars, for example, contain pesticides.

Despite their usefulness, there is ample evidence that pesticides worldwide are being overused and misused. Most concern centres on the potential health effects of pesticide residues in our food and on the risk of harm to pesticide applicators. The damaging effects of pesticides on our wildlife species and their habitat, on the other hand, are not generally recognized.

This fact sheet is about birds and how they are being affected by pesticides. Occasionally, pesticides are used specifically to protect birds and their habitat — for example, to control damaging species that have been introduced, accidentally or intentionally, into the birds' environment. More often, however, birds are innocent victims in our relentless war against species that compete with us.

What are pesticides?

The word *pesticide* means "pest killer." Legally, the term includes chemicals, organisms, and devices designed to destroy, attract, or repel pests. A pest is any organism that is unwanted by humans at a specific time or in a specific place. The ancient Romans and Chinese, among others, used various minerals and plant extracts to kill or repel insects and to attack fungi that caused plant disease. Widespread use of manufactured chemical pesticides began in the 1930s and dramatically increased after World War II.

Pesticide types

Pesticides are grouped according to the pests they control. For example, *insecticides* are used against insects, such as mosquitoes and other biting flies, as well as agricultural, forest, turf, and household pests; *herbicides* are used against unwanted plants on rights-of-way, lawns, golf courses, and cropland, as well as in orchards and tree plantations; *fungicides* are used against fungi, which cause many plant diseases and plant rot; and *rodenticides* are used against rodents, such as rats, mice, and voles in buildings and orchards.

Pesticide forms

Pesticides are sold in many forms, such as aerosols, granules, baits, and powders or concentrates that are mixed with water and applied as liquids. They may be applied in a variety of ways, including being sprayed from an airplane or from a sprayer pulled behind a tractor, dissolved in irrigation water, buried in the soil, sprinkled as granules or pellets on the ground next to plants, applied as a coating on

seeds, or inserted into livestock collars or into bait material.

A pesticide's form determines how a bird may come into contact with it — by mistaking it for food or drink, absorbing it through the feet, inhaling it while preening its feathers. Granular pesticides (mixed with clay, sand, or dried pieces of corn cob) are especially hazardous to pecking birds because the birds may mistake the granules for food or grit, which they use to grind their food.

How do pesticides work?

A pesticide works by disrupting a vital bodily process, such as photosynthesis in plants, or by destroying a major organ, such as a caterpillar's intestine. Organophosphates and carbamates, the most common insecticides in use today, are known as "cholinesterase-inhibiting pesticides," because they kill by interfering with an enzyme vital for nerve transmission. Pest populations exposed to repeated applications of a pesticide may evolve genetic resistance to it, so that the pesticide no longer works.

Pesticides do not actually "recognize" target organisms. They are "programmed" to affect a process or organ, and any organism that has such a process or organ can be affected. Thus, a pesticide may kill species that people wish to keep as well as species that they label as "pests." To limit the number of nontarget species at risk, it is wise to use *selective* pesticides (those that affect only one group of pest organisms, such as flies) rather than *nonspecific* pesticides (those that are toxic to a broad range of organisms, such as mammals, birds, fish, and insects). The selectivity of a pesticide is therefore key to its ecological impact.

Which pesticides most affect birds?

In Canada, more than 30 registered pesticides can poison wild birds. Most of these are the cholinesterase-inhibiting *organophosphates* and *carbamates*. These insecticides work well against a broad range of insects and are often less expensive than many alternatives, which adds to their popularity. Unfortunately, they are acutely (i.e., immediately) toxic and not very selective, affecting most vertebrates and invertebrates. They also break down quickly in water or soil, which means that they often need to be applied to crops more than once per growing season. When accidentally eaten by or absorbed into the body of a wild animal, they are detoxified rapidly and excreted — unless, of course, the animal dies first. Mammals are much better at detoxifying organophosphates and carbamates. For example, birds are 100 times more sensitive than mammals to the common insecticide diazinon.

Organochlorine insecticides, such as DDT, also work well against a broad range of insects, but they remain toxic much longer. Although most organochlorines were discontinued in Canada in the 1970s after causing population declines in Peregrine Falcons and other bird species, traces are still found in the environment (particularly in areas of former heavy use, such as orchards) and wildlife. A dose

Some of the ways that birds pick up pesticides



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1. Gulls and field sparrows feed on freshly killed grasshoppers in a newly sprayed field.
2. A Wood Duck and a Great Blue Heron ingest pesticide runoff in a residential pond while preening and feeding.
3. Warblers in forests sprayed with toxic organophosphate insecticides often die from feeding on the insects and absorbing the chemical through their skin and lungs.

that was effective against insects was not necessarily directly toxic to birds; however, because the pesticides persisted for decades and accumulated in the food chain, it was possible for birds, especially predatory species, to accumulate a lethal dose over time. Persistent organochlorines are still legally used in some southern hemisphere countries visited by Canadian migratory birds.

Which pesticides are less toxic to birds?

Some pesticides are much more "target-specific" and less toxic to birds. They still need to be used with caution, however. For example, *synthetic pyrethroids* are not generally acutely toxic to birds or mammals and are therefore more selective than the organophosphates or carbamates. However, they are particularly toxic to fish, amphibians, and terrestrial and aquatic invertebrates. Selectivity is often a relative concept.

Microbes that are specific to the pest or to a small number of related insects as well as *insect predators* or *insect parasites* released in large numbers to prey on a particular pest are usually the most target-specific of all insect control options. They result in the least amount of disruption to the natural environment. One microbe commonly used against insect pests is *Bacillus thuringiensis kurstaki* (Btk), a bacterium that destroys caterpillar intestines. Caterpillar "pests" include the gypsy moth, spruce budworm, and European corn borer.

Most herbicides and fungicides are also not acutely toxic to birds or other animals. However, several have been shown to interfere with reproduction in birds in laboratory studies (although not yet in the field). In addition, several herbicides and fungicides are toxic to fish and earthworms, so there may be less food-rich habitat available to some birds after their use.

Which birds are most vulnerable?

Some birds are more likely than others to be exposed to pesticide residues. One group at risk is birds that eat large quantities of foliage that might have been recently sprayed, such as waterfowl and game birds. Another group at risk is seed-eating songbirds, which are attracted to insecticide gran-

ules and pesticide-treated seeds. Species that gorge on pest insects, such as grasshoppers, are particularly vulnerable in times of pest outbreak. Finally, scavengers and predators that take slow or disabled prey are at a high risk of ingesting other birds or mammals that have been poisoned.

How do pesticides affect wild birds?

Pesticides can kill birds directly, poison them without killing them directly, or affect them by reducing their food or habitat resources.

Lethal poisoning

Insects and vegetation sprayed with insecticides can contain sufficient residues to kill hungry birds. Die-offs, like those described in Box 1, can happen, even when pesticides are applied responsibly, following the instructions on the label — hence the importance of monitoring product performance and reporting problems. It takes only one or two small granules of the more toxic organophosphate or carbamate insecticides to kill a small bird. As well, sufficient quantities of pesticide residues remain in the stomachs of poisoned birds and mammals to kill predators and scavengers, such as eagles and crows.

Sublethal poisoning

Not all poisonings result in immediate death. A poisoned bird may lose weight, increasing its chances of dying from other stresses, such as bad weather. It may sing less and fail to attract a mate or defend a territory. It may raise smaller broods, provide less food for its chicks, or exhibit abnormal behaviour towards its mate. A weakened bird may also be less able to escape from or defend against predators.

Impacts are not always easy to predict. Songbirds nesting in grassland sprayed with the toxic insecticide carbofuran have survived and successfully reared their young, although gulls have perished and Burrowing Owls have abandoned their nests and disappeared under the same circumstances (see Box 1). Survival is likely due to the ability of some species to eliminate the insecticide from the body before a lethal or debilitating dose is acquired.

A Red-tailed Hawk devours a teal that has been feeding on plants recently sprayed with organophosphates.



A bluebird eats a grasshopper immediately after it has been sprayed.



Numbers of Horned Larks may be affected by pesticides, especially granular insecticides.



Box 1

Examples of mass poisoning of Canadian birds by pesticides.

There are relatively few well-documented cases of mass pesticide poisoning of birds, at least in Canada. To some, this indicates that such events are rare; others point to the inaccessibility of farm fields and treated forests, the rapid disappearance of carcasses after a kill, and the general lack of monitoring for such events. Mass poisonings need not be spectacular — they may involve large numbers of widely distributed birds. Kills of small birds are seldom reported — yet we know that, on average, they are at higher risk of poisoning. In the United States, where the reporting rate is thought to be better than in Canada, a pesticide kill is reported, on average, every two weeks for birds of prey alone. Whether bird poisonings in Canada are frequent enough to contribute to current population declines is an open question.

Between June 1986 and September 1988, at least five cases of poisoning of flocks of Canada Geese were recorded on southern Ontario golf courses and in other grassy areas. The birds died within minutes of swallowing grass sprayed with the insecticide *diazinon*. Large kills (up to 700 in a single kill) of Arctic-nesting Brant geese were routinely observed on the golf courses of Long Island before the pesticide's use on golf courses was banned in the United States. Diazinon is still used extensively on Canadian golf courses and as a "home and garden" insecticide.

After a Saskatchewan farmer applied granules of *carbofuran* to control flea beetles in a canola field in 1984, he returned to find the bodies of several thousand Lapland Longspurs dotting the field. These Arctic migrants travel in flocks numbering tens of thousands. During migration, they are vulnerable to pesticides used on farms, because they favour recently seeded fields and spend much of their time pecking at the ground in search of food. The Canadian Wildlife Service (CWS) is currently in discussion with the registration authorities over the continued use of this product.

The years 1984 to 1986 were bad grasshopper years in the Canadian prairies. At least three cases of poisoning of Ring-billed and California gulls were reported when the gulls attempted to feed on grasshoppers sprayed with *carbofuran*. CWS-sponsored research showed that colonies of the endangered Burrowing Owls were abandoned when this chemical was used nearby. As of 1998, this insecticide can no longer legally be used against grasshoppers. Numerous less toxic alternatives are registered.

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Toxic perches loaded with the organophosphate *fenthion* to kill pest birds have been responsible for at least 15 kills of birds of prey in the last 10 years in the United States. Several endangered Peregrine Falcons are known to have been killed by this product. CWS-sponsored research has shown that birds of prey capturing exposed sparrows or pigeons will die and that debilitation of the pest bird makes capture likely. Cases have yet to be reported from Canada, although the product is registered in our country.

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Food and habitat loss

In most industrialized countries, herbicides are used much more heavily than other pesticides. The target "weeds" (such as lambsquarters), the nontarget plants that happen to be sensitive to the herbicide used, and the protein-rich insects that live on these plants are all essential food to birds, whether breeding adults or their broods. Pesticide use affects food production in other ways, as well. Seed set and berry production are reduced if pollinating bees are killed by pesticides. Pesticide pollution of wetlands reduces the "crop" of aquatic insects essential to the growth and development of aquatic birds. The use of insecticides on lawns reduces the number of earthworms, which in turn affects American Robins.

The use of pesticides on farmland has further reduced the amount of safe habitat available for birds that already have to make do with small woodlots, hedgerows, shelterbelts, and farm ponds for nesting or feeding. Even habitats bordering agricultural fields can become a liability if birds are attracted into the fields and then inadvertently poisoned by toxic insecticides. Herbicide use, such as in forestry, may cause ground-dwelling birds to lose the leafy shelters that protect them against predators and bad weather. The potential for the herbicide spray to drift through the air and contaminate distant wetlands through water runoff is also a concern.

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What is the bottom line?

Pesticides have not yet caused any bird species to become extinct in Canada, although Peregrine Falcons almost died out in eastern Canada in the 1960s before the government phased out DDT and other organochlorines. However, only a small proportion of current pesticide bird kills are documented. Many poisoning incidents are not reported because the poisoned birds hide and the carcasses quickly decompose or are eaten by scavengers. Also, some pesticide losses are misdiagnosed as cases of electrocution or trauma.

Canadian researchers are only beginning to understand the overall effects of pesticide use on bird abundance and diversity. Could pesticides affect a keystone species (one that plays a vital role in the ecosystem), with hard-to-predict consequences for wildlife? It is not always possible to unravel the effects of pesticides from the effects of the many other factors that contribute to the pollution and loss of habitat that threaten some wildlife species. Although British studies suggest that changes to habitat after the use of herbicides may have more serious consequences for some bird populations than direct losses through pesticide poisoning, it is unclear whether this applies to North America, where our use of highly toxic insecticides tends to be higher.

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Également disponible en français sous le titre
Les pesticides et les oiseaux sauvages.

Published by the authority of the
Minister of the Environment
©Minister of Public Works and
Government Services Canada, 1998
Catalogue number CW69-4/98-1998E
ISBN 0-662-26641-2
Text: Pierre Mineau
Drawings: Roelof Idema for CWS

Pesticides and wild birds



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Captions for cover photos

1. Pesticide spraying on farmland.
Photo: Robert McCaw
2. Swainson's Hawks that breed in Canada have died during pesticide spraying in their Argentine wintering areas.
Photo: Robert McCaw
3. American Robin killed by pesticides.
Photo: Canadian Wildlife Service
4. Endangered Burrowing Owls have abandoned their breeding colonies when pesticides were applied to nearby fields.
Photo: Canadian Wildlife Service

Pesticides are considered by many to be essential to our everyday existence, or, at least, to our current standard of living. They have saved countless lives by reducing the impact of diseases that are transmitted by mosquitoes and other insect pests, such as typhus and malaria. They also play a major role in humankind's efforts to grow and store enough food to feed itself. The vast majority of Canadians are indirect consumers of pesticides through the food they buy. Many use pesticides directly, often without realizing it: outdoor paints and wood preservatives, disinfectants, and flea collars, for example, contain pesticides.

Despite their usefulness, there is ample evidence that pesticides worldwide are being overused and misused. Most concern centres on the potential health effects of pesticide residues in our food and on the risk of harm to pesticide applicators. The damaging effects of pesticides on our wildlife species and their habitat, on the other hand, are not generally recognized.

This fact sheet is about birds and how they are being affected by pesticides. Occasionally, pesticides are used specifically to protect birds and their habitat — for example, to control damaging species that have been introduced, accidentally or intentionally, into the birds' environment. More often, however, birds are innocent victims in our relentless war against species that compete with us.

What are pesticides?

The word *pesticide* means "pest killer." Legally, the term includes chemicals, organisms, and devices designed to destroy, attract, or repel pests. A pest is any organism that is unwanted by humans at a specific time or in a specific place. The ancient Romans and Chinese, among others, used various minerals and plant extracts to kill or repel insects and to attack fungi that caused plant disease. Widespread use of manufactured chemical pesticides began in the 1930s and dramatically increased after World War II.

Pesticide types

Pesticides are grouped according to the pests they control. For example, *insecticides* are used against insects, such as mosquitoes and other biting flies, as well as agricultural, forest, turf, and household pests; *herbicides* are used against unwanted plants on rights-of-way, lawns, golf courses, and cropland, as well as in orchards and tree plantations; *fungicides* are used against fungi, which cause many plant diseases and plant rot; and *rodenticides* are used against rodents, such as rats, mice, and voles in buildings and orchards.

Pesticide forms

Pesticides are sold in many forms, such as aerosols, granules, baits, and powders or concentrates that are mixed with water and applied as liquids. They may be applied in a variety of ways, including being sprayed from an airplane or from a sprayer pulled behind a tractor, dissolved in irrigation water, buried in the soil, sprinkled as granules or pellets on the ground next to plants, applied as a coating on

seeds, or inserted into livestock collars or into bait material.

A pesticide's form determines how a bird may come into contact with it — by mistaking it for food or drink, absorbing it through the feet, inhaling it, rubbing against a contaminated surface and then ingesting it while preening its feathers. Granular pesticides (mixed with clay, sand, or dried pieces of corn cob) are especially hazardous to pecking birds because the birds may mistake the granules for food or grit, which they use to grind their food.

How do pesticides work?

A pesticide works by disrupting a vital bodily process, such as photosynthesis in plants, or by destroying a major organ, such as a caterpillar's intestine. Organophosphates and carbamates, the most common insecticides in use today, are known as "cholinesterase-inhibiting pesticides," because they kill by interfering with an enzyme vital for nerve transmission. Pest populations exposed to repeated applications of a pesticide may evolve genetic resistance to it, so that the pesticide no longer works.

Pesticides do not actually "recognize" target organisms. They are "programmed" to affect a process or organ, and any organism that has such a process or organ can be affected. Thus, a pesticide may kill species that people wish to keep as well as species that they label as "pests." To limit the number of nontarget species at risk, it is wise to use *selective* pesticides (those that affect only one group of pest organisms, such as flies) rather than *non-selective* pesticides (those that are toxic to a broad range of organisms, such as mammals, birds, fish, and insects). The selectivity of a pesticide is therefore key to its ecological impact.

Which pesticides most affect birds?

In Canada, more than 30 registered pesticides can poison wild birds. Most of these are the cholinesterase-inhibiting *organophosphates* and *carbamates*. These insecticides work well against a broad range of insects and are often less expensive than many alternatives, which adds to their popularity. Unfortunately, they are acutely (i.e., immediately) toxic and not very selective, affecting most vertebrates and invertebrates. They also break down quickly in water or soil, which means that they often need to be applied to crops more than once per growing season. When accidentally eaten by or absorbed into the body of a wild animal, they are detoxified rapidly and excreted — unless, of course, the animal dies first. Mammals are much better than birds at detoxifying organophosphates and carbamates. For example, birds are 100 times more sensitive than mammals to the common insecticide diazinon.

Organochlorine insecticides, such as DDT, also work well against a broad range of insects, but they remain toxic much longer. Although most organochlorines were discontinued in Canada in the 1970s after causing population declines in Peregrine Falcons and other bird species, traces are still found in the environment (particularly in areas of former heavy use, such as orchards) and wildlife. A dos

Are birds in trouble?

Like the proverbial canary in the coal mine, many of our bird populations are showing signs of trouble. Although a few species have clearly benefited from the human presence, those species that inhabit our farmland and other open areas are more likely than other species to be in decline. This trend is even more extreme in Europe, where the majority of common farmland birds are decreasing. The declines have been blamed not only on habitat loss, but also on agricultural intensification, in which pesticides play a key role.

Some of the ways that birds pick up pesticides



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Gulls and field sparrows feed on freshly killed grasshoppers in a newly sprayed field.

A Wood Duck and a Great Blue Heron ingest pesticide runoff in a residential pond while preening and feeding.

Warblers in forests sprayed with toxic organophosphate insecticides often die from feeding on the insects and absorbing the chemical through their skin and lungs.

that was effective against insects was not necessarily directly toxic to birds; however, because the pesticides persisted for decades and accumulated in the food chain, it was possible for birds, especially predatory species, to accumulate a lethal dose over time. Persistent organochlorines are still legally used in some southern hemisphere countries visited by Canadian migratory birds.

Which pesticides are less toxic to birds?

Some pesticides are much more “target-specific” and less toxic to birds. They still need to be used with caution, however. For example, *synthetic pyrethroids* are not generally acutely toxic to birds or mammals and are therefore more selective than the organophosphates or carbamates. However, they are particularly toxic to fish, amphibians, and terrestrial and aquatic invertebrates. Selectivity is often a relative concept.

Microbes that are specific to the pest or to a small number of related insects as well as *insect predators* or *insect parasites* released in large numbers to prey on a particular pest are usually the most target-specific of all insect control options. They result in the least amount of disruption to the natural environment. One microbe commonly used against insect pests is *Bacillus thuringiensis kurstaki* (Btk), a bacterium that destroys caterpillar intestines. Caterpillar “pests” include the gypsy moth, spruce budworm, and European corn borer.

Most herbicides and fungicides are also not acutely toxic to birds or other animals. However, several have been shown to interfere with reproduction in birds in laboratory studies (although not yet in the field). In addition, several herbicides and fungicides are toxic to fish and earthworms, so there may be less food-rich habitat available to some birds after their use.

Which birds are most vulnerable?

Some birds are more likely than others to be exposed to pesticide residues. One group at risk is birds that eat large quantities of foliage that might have been recently sprayed, such as waterfowl and game birds. Another group at risk is seed-eating songbirds, which are attracted to insecticide gran-

ules and pesticide-treated seeds. Species that gorge on pest insects, such as grasshoppers, are particularly vulnerable in times of pest outbreak. Finally, scavengers and predators that take slow or disabled prey are at a high risk of ingesting other birds or mammals that have been poisoned.

How do pesticides affect wild birds?

Pesticides can kill birds directly, poison them without killing them directly, or affect them by reducing their food or habitat resources.

Lethal poisoning

Insects and vegetation sprayed with insecticides can contain sufficient residues to kill hungry birds. Die-offs, like those described in Box 1, can happen, *even when pesticides are applied responsibly, following the instructions on the label* — hence the importance of monitoring product performance and reporting problems. It takes only one or two small granules of the more toxic organophosphate or carbamate insecticides to kill a small bird. As well, sufficient quantities of pesticide residues remain in the stomachs of poisoned birds and mammals to kill predators and scavengers, such as eagles and crows.

Sublethal poisoning

Not all poisonings result in immediate death. A poisoned bird may lose weight, increasing its chances of dying from other stresses, such as bad weather. It may sing less and fail to attract a mate or defend a territory. It may raise smaller broods, provide less food for its chicks, or exhibit abnormal behaviour towards its mate. A weakened bird may also be less able to escape from or defend against predators.

Impacts are not always easy to predict. Songbirds nesting in grassland sprayed with the toxic insecticide carbofuran have survived and successfully reared their young, although gulls have perished and Burrowing Owls have abandoned their nests and disappeared under the same circumstances (see Box 1). Survival is likely due to the ability of some species to eliminate the insecticide from the body before a lethal or debilitating dose is acquired.

A Red-tailed Hawk devours a teal that has been feeding on plants recently sprayed with organophosphates.



A bluebird eats a grasshopper immediately after it has been sprayed.



Numbers of Horned Larks may be affected by pesticides, especially granular insecticides.



Box 1

Examples of mass poisoning of Canadian birds by pesticides.

There are relatively few well-documented cases of mass pesticide poisoning of birds, at least in Canada. To some, this indicates that such events are rare; others point to the inaccessibility of farm fields and treated forests, the rapid disappearance of carcasses after a kill, and the general lack of monitoring for such events. Mass poisonings need not be spectacular — they may involve large numbers of widely distributed birds. Kills of small birds are seldom reported — yet we know that, on average, they are at higher risk of poisoning. In the United States, where the reporting rate is thought to be better than in Canada, a pesticide kill is reported, on average, every two weeks for birds of prey alone. Whether bird poisonings in Canada are frequent enough to contribute to current population declines is an open question.

Between June 1986 and September 1988, at least five cases of poisoning of flocks of Canada Geese were recorded on southern Ontario golf courses and in other grassy areas. The birds died within minutes of swallowing grass sprayed with the insecticide *diazinon*. Large kills (up to 700 in a single kill) of Arctic-nesting Brant geese were routinely observed on the golf courses of Long Island before the pesticide's use on golf courses was banned in the United States. Diazinon is still used extensively on Canadian golf courses and as a "home and garden" insecticide.

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Également disponible en français sous le titre
Les pesticides et les oiseaux sauvages.

Published by the authority of the
Minister of the Environment
©Minister of Public Works and
Government Services Canada, 1998
Catalogue number CW69-4/98-1998E
ISBN 0-662-26641-2
Text: Pierre Mineau
Drawings: Roelof Idema for CWS

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Piping Plover



The Piping Plover *Charadrius melodus* is a small shorebird which nests on sandy or gravelly beaches. Unlike most shorebirds, which breed at northern latitudes, the Piping Plover inhabits the temperate regions of North America, where much of the habitat that meets its very specific needs is being put to human uses. Historical population information on Piping Plovers is limited, with relatively few surveys having been carried out before the 1980s. Recent counts suggest that their numbers are dropping. Because of decreases in plover populations and threats posed by human use of its habitat and predation, the Piping Plover is now officially designated as "endangered" in Canada.

General description

On a beach, the Piping Plover blends well into its surroundings: its head and back are the colour of dried sand, and it has a white rump, a partially black tail, a black band above its white forehead, and a single, black "belt" or breastband (also referred to as a collar or neck-band) that contrasts with its white breast and abdomen. Its bright orange legs match its orange, black-tipped bill. Adults weigh between 45 and 65 g and are about the size of a blue-bird. Both sexes are similar in appearance; however, males tend to have broader and more distinct black bands on the head and breast than females. The adult winter plumage, which is indistinguishable from that of the juvenile plumage, lacks the black head and breast bands. The orange legs of this plover distinguish it from other plover species on the wintering grounds.

Piping Plovers may live as long as 14 years; however, most probably survive less than 5 years. They feed on aquatic and terrestrial invertebrates that they capture with their bill by alternately running and pecking or probing along river, lake, and ocean shores.

This plover is the rarest of six "belted" plover species found in North America. The most well known of these plovers is the "double-belted" Killdeer *Charadrius vociferus*, which many people associate with the broken

wing act that it puts on when an enemy gets too close to its nest or young. The single band or "belt" of the smaller Piping Plover tends to be incomplete in coastal birds and complete in interior birds. Some scientists have considered this feature to be the basis for dividing the Piping Plover into two subspecies; however, a recent genetic study does not support this opinion.

Distribution and habitat

The Piping Plover nests only in North America. Its breeding distribution can be divided into three geographical areas: the Atlantic coast from Newfoundland to South Carolina, the Great Lakes (Michigan), and the Great Plains (prairie provinces to Nebraska). In Canada, Piping Plovers have been extirpated as a breeding species from the shores of the Great Lakes where they once nested. On the east coast, plovers nest on sandy or gravel-sand beaches, particularly those overwashed by past storms, while in the prairies most breed on gravel back-shores of shallow, saline lakes, and a few on sandy shores of larger prairie lakes. Others have used river sandbars. The plover's nesting habitat is not stable, as its availability depends on water levels and plant growth. Human-altered habitat (e.g., a gravel road, a parking lot) is also known to have been used by plovers. Artificial sites are not commonly used, and nest success is lower there than in natural habitats, as evidenced at sites in the United States.

Piping Plovers spend only 3-4 months on the breeding grounds before beginning their migration to their winter haunts in July-September. Little is known about their migration behaviour; however, on the wintering grounds, one study showed that most plovers tend to return, for at least part of their time, to the area they inhabited the previous year. From September to April, inland populations can be found along the coast of the Gulf of Mexico from Florida to Mexico. Atlantic breeding birds winter along the southern Atlantic seacoast of the United States, primarily from North Carolina to Florida. Plovers have also been sighted on some of the Caribbean islands. On the wintering grounds, Piping Plovers spend most of their day feeding along sandflats or beaches. The amount of time they spend feeding tends to increase when temperatures decrease and tide levels subside. By late April, most plovers have left the southern climes for their northern breeding grounds.

Courtship and territorial behaviour

Each spring, Piping Plovers arrive on Canadian breeding grounds in late April or May, and shortly thereafter males begin flight and ground displays in their efforts to establish a territory and attract a mate. The plover's classic aerial display involves a complex flight with slow exaggerated wingbeats, accompanied by rapid persistent calling over feeding and nesting habitat. These flights may reach heights of 35 m and can continue for as long as half an hour. On the ground, males chase each other with their backs hunched and head lowered or run

 Breeding range
 Wintering range



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parallel to each other along invisible territory borders as they try to settle boundary disputes. Territory size is variable, ranging from 500 to 51 000 m². Males call vigorously while scraping shallow depressions with their feet in sand or sand-gravel pavement. Females inspect scrapes, presumably for their suitability as a nest site, while males stand adjacent to the depressions with partially outstretched wings and fanned tails. Small pebbles, seashell bits, or bone fragments are tossed toward the scrape and eventually form the lining of the nest. The male courts the female using high marching-like steps and an exaggerated upright body posture. Mating usually takes place on the nesting territory.

Nesting and chick rearing

Female Piping Plovers usually lay four buff-coloured, black-speckled eggs during early May. The eggs, averaging 31 mm x 24 mm, are laid on alternate days in a sand or pebble-lined nest with their pointed ends toward the centre of the nest. Both sexes share incubation duties, which last on average 28 days. Most eggs hatch in June, and all successful eggs in a nest hatch within 48 hours of each other. The young emerge fully feathered and leave the nest within hours of drying off. Chicks feed on their own, but are carefully guarded by both parents. During inclement weather, chicks seek refuge and warmth under the adults. When danger arises, young plovers freeze in a crouched position, making them difficult to locate among sand and gravel. The female abandons the family, usually by mid-July, leaving the male to care for the young until the family disperses. Young are capable of making short flights at about 20–25 days of age and are able to maintain flight by 30 days of age. They may arrive on the wintering ground as early as late August.

Females are capable of nesting when they are one year old and may re-nest once or twice if their nests are destroyed, but they rear only one brood per year. Piping Plovers usually keep the same mate during the breeding season, but may switch partners after nest failure. Most plovers select new mates during the next nesting season.

Only 2–43% of the young that fledge return close to where they were raised. This probably reflects wide dispersal and a high death rate among young plovers in their first year. In contrast, 25–97% of breeding plovers return to the area where they nested in a previous year.

Threats

Enemies of the Piping Plover include both birds and mammals. The Piping Plover's plumage coloration helps it to blend in with its natural environment and thereby assists in concealing it from predators. When disturbed, Piping Plovers silently slip off their nests and walk away from approaching intruders. In order to distract a potential predator, the plover may pretend to be injured as it leads the enemy away from its nest. Eggs are subject to gull, crow, raccoon, fox, and skunk predation, whereas adults are potential prey of falcons.

On the Atlantic coast, all-terrain vehicles,

swimmers, and beachcombers disturb Piping Plovers and may damage their nests and eggs and interrupt feeding of plover chicks. Studies show that fewer young are raised on beaches that are popular for recreation, compared with beaches with less disturbance. On the prairies, the threats to Piping Plovers include all-terrain vehicles, cattle trampling of nesting and brood-rearing habitat as the animals approach the water's edge for a drink, and the reduction in nesting habitat in high water years as a result of dams. On the plover's wintering grounds in the southern United States, continued development of recreational property and dumping of industrial wastes threaten beaches where plovers feed.

Status and conservation

Hunting contributed to the plover's decline in the nineteenth century, but populations rallied as protection was afforded by the Migratory Birds Convention Act of 1917. Several factors may be involved in recent regional declines, including human disturbance, loss of habitat, and predation. Evidence of widespread decline in the Piping Plover population contributed to the decision in 1985 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) to classify this bird as an endangered species in Canada. In 1986, the plover's status in the United States became officially known as "endangered" in the Great Lakes and "threatened" on the Great Plains and the Atlantic coast. Unfortunately, unlike the United States, Canada has no federal endangered species act that would provide additional protection for this species.

The plover's future is questionable, as a recent analysis of plover production on the Canadian prairies and the American Great Plains suggests that the plover may not be producing enough young to maintain a stable population. On the Atlantic coast, predation and human recreational activities are difficult problems to counteract. The forecast climatic warming of the atmosphere may also reduce the plover's habitat through prairie drought and coastal flooding.

The 1988 North American population is estimated to have been about 4090 individuals, of which about 1470 adults (36%) were thought to occur in Canada. In the Atlantic coast region of Canada, there were about 470 adults, whereas the Canadian prairie population numbered about 1000 adults. The breeding population of Piping Plovers can vary from one year to another depending on various factors including habitat availability. Both the Canadian Wildlife Service and the United States Fish and Wildlife Service, in cooperation with other agencies, have developed recovery plans that should maintain or increase the plover's numbers. Conservation measures, such as signs, patrols, surveys, and public education, by various non-government organizations, provincial wildlife agencies, and the Canadian Parks Service, have contributed to attempts to protect and learn more about this plover. Research by government and university scientists is aiding our

understanding of the plover's biology and population dynamics. This knowledge, combined with the help of a conservation-minded public and wise land management by landowners, will help ease the plover's plight.

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le titre *Le Pluvier siffleur*



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Service

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A member of the Conservation
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Published by Authority of the
Minister of the Environment

© Minister of Supply
and Services Canada, 1989
Catalogue No.: CW69-4/78E

ISBN: 0-662-17198-5

Text: J. Paul Goossen

Photo: Winnifred (Cairns) Wake

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Raccoon



Raccoon tracks



The common raccoon *Procyon lotor* is probably best known for its mischievous-looking face mask. The name *raccoon* is derived from the Algonquian Indian word *arakun*, meaning "he scratches with his hand." The species name, *lotor*, refers to the raccoon's supposed habit of washing food with its front paws. This activity, however, is probably associated with the location and capture of aquatic prey such as crayfish. The behaviour is no doubt innate, because captive raccoons have been observed attempting to "wash" their food in the absence of water.

Distribution

Six species of raccoons occur in North, Central, and South America as well as on some of the Caribbean Islands. However, *Procyon lotor* is found only in southern Canada, portions of the United States, and Central America. The species inhabits all provinces of Canada except Newfoundland and is gradually expanding its range northward as land is cleared for agricultural purposes. During the 1930s the raccoon was successfully introduced into Germany and the Soviet Union. Today, its range has expanded to include Luxembourg, West Germany, the Netherlands, and France.

Movements and home ranges of raccoons vary greatly depending on habitat, population density, and food supply. The *home range* is the area used by an animal for food, water, and shelter in its normal, day-to-day movements. In rural agricultural areas (eastern North America), home ranges between 1 and 4 km² are common, whereas in prairie habitat, areas as large as 50 km² have been used by raccoons. At the other extreme, the area utilized by urban raccoons has been documented at less than 0.1 km². Generally, home ranges of individual raccoons overlap, and there is little evidence of territoriality, especially in urban areas.

As with home ranges, raccoon densities vary significantly depending on the type of habitat. Estimates of 5-10 raccoons per square kilometre are common in rural agricultural areas. In urban areas, exceptional numbers of raccoons as high as 100 per square kilometre have been



recorded. However, densities as low as 1 per square kilometre may occur in prairie habitat.

Raccoons are able to live in a diversity of habitats. The only apparent requirements are a source of water, food, and a protected area for denning. The best habitats are hardwood swamps, floodplain forests, fresh- and saltwater marshes, and farmland, both cultivated and abandoned. On the prairies, raccoons are most abundant in woodlot and wetland areas. This highly adaptable animal is also very common in many cities of North America.

Description

Raccoons are usually a grizzled grey in color and have a conspicuous black face mask and a tail marked with 5-10 alternating black and brown rings. Body coloration can vary from albino to melanistic (black) or brown. An annual moult of the fur begins in the spring and lasts about three months.

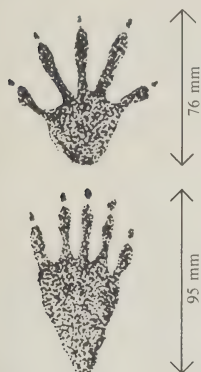
The head is broad with a pointed snout and short rounded ears (4-6 cm). The eyes are black. Total body and tail length for adults averages 80 cm; males are generally 25% larger than females. Raccoons in northern latitudes tend to be heavier (6-8 kg) than their southern counterparts (4 kg). However, fall weights for adults have reached 28 kg in some areas. The life span of raccoons in the wild is estimated at 3-5 years; most populations are completely replaced over 7 years. However, longevity records of 12 and 16 years have been noted in captivity and in the wild, respectively.

Diet

Raccoons are omnivorous and will consume practically any food item, plant or animal. Corn, crayfish, fruits, and nuts are preferred, but there is a seasonal shift in diet depending on availability of food items. During the spring animal matter, including invertebrates and insects, makes up the major portion of the diet. Crayfish are preferred, but muskrats, squirrels, rabbits, waterfowl eggs, and freshwater clams are also consumed. In the summer, plant material, including fruits and nuts, becomes more important. Wild cherries, gooseberries, elderberries, wild grapes, strawberries, and garden items such as potatoes and sweet corn are relished. As well, crayfish, frogs, small fish, turtles, beetle grubs, grasshoppers, earthworms, crickets, and snails are eaten during the summer.

The fall diet is extremely important for raccoons in northern latitudes because sufficient fat reserves must be accumulated to sustain the animals during winter denning. Corn is the mainstay of the fall diet in most areas where it is available; however, acorns, beechnuts, hazelnuts, and grapes are also consumed. The nests of insects, including hornets, bumblebees, termites, and ants are raided mainly for the larvae; the thick fur that is characteristic of the raccoon's fall and winter coat protects it from the stings of irate adult hornets or bees. Fat is built up over the entire body and even around the tail bone and may be 2.5 cm thick on the

the raccoon's footprints resemble those of a human being. Because the front toes can be opened wide, the forepaws can be used skillfully to handle food and other objects.



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back. In fact, by late fall about half of the animal's total body weight may be fat. In northern areas the raccoon lives on its stored body fat during the winter, but it continues to forage year-round farther south where nuts and corn are plentiful. In suburban areas, raccoons often raid garbage bins or forage earthworms, beetles, and grubs on residential lawns. Raccoons can also be a menace to farmers because they may eat domestic fowl and eggs.

Life history

In northern latitudes (northern U.S., southern Canada), the annual life cycle of raccoons consists of a breeding period during late winter and early spring, a growth and fattening period during the summer and fall, and a winter denning period. In more southern latitudes, winter denning occurs only during periods of inclement weather.

The breeding season generally begins in late January or early February in the northern parts of the raccoon's range. Mating tends to take place in March in most areas. Birth of offspring peaks during May, although births have been recorded as early as March or as late as September. Year-round breeding has been reported for raccoons in southern areas.

Male raccoons are polygamous or will mate with several females in succession. Females, however, are monogamous, and will mate with only one male and will not tolerate other males after mating has occurred. Juvenile females often breed during their first year. Juvenile males, although capable, usually do not have the opportunity to mate until their second year because of competition from adult male raccoons. Litter sizes tend to be larger in the northern part of the range. Between three and seven young per litter are common in northern latitudes; however, litters of two or three young are usually the rule in southern areas. The gestation period averages 63 days.

Raccoons are born without teeth and with eyes closed, and they weigh approximately 75 g. The eyes open at 2 weeks of age, and the teeth erupt at about 19 days. By about 10 days of age the young are already sporting the familiar facial mask and colour patterns typical of the species. The young remain in the maternity den for about eight weeks and then leave to forage with the female, although they are not fully weaned for almost two months. The adult male plays no role in raising the young.

The family group, which consists of the adult female and young, is quite sociable, foraging during the night and denning together during the day. The mother teaches her young to climb, hunt, and swim during their first summer. The family unit generally remains together until the adult female has her next litter, usually the following spring. Juvenile males often disperse from the adult females' home range, although juvenile females may remain within the vicinity of the mother's range.

In northern latitudes and during periods of inclement weather, raccoons den up for the winter. This allows conservation of energy (fat

reserves) when food is not available. It is not hibernation, but a period of inactivity. The body temperature does not drop, and the animal's activity appears to be governed by the air temperature. Preferred denning sites include hollow trees, stumps, logs, caves, vacant groundhog or fox burrows, and buildings such as barns. In city areas, denning sites include residential chimneys, sewers, garages, attics, trees, and culverts. Adult males usually den solitarily, but the family unit often dens together during the first winter. Communal dens containing as many as 23 raccoons have been reported; however, 4 or 5 is the more common number. Although usually one den is used during the winter, several different dens are utilized for sanctuary during other seasons.

Limits to population

Humans are the major predator of the raccoon. They prize its fur and take between 2 and 4 million pelts annually in North America. As well, thousands of raccoons are killed by automobiles each year. Another major source of mortality is disease. Since 1983, several thousand raccoons have succumbed annually to rabies in the mid-Atlantic and southern United States. The disease is currently spreading north toward Canada. As well, thousands of raccoons die annually from canine distemper, particularly in eastern Canada and the United States. Parasites such as lice, fleas, and ticks are often found on raccoons, but do not appear to be a significant source of mortality.

Other predators of raccoons include pumas, bobcats, coyotes, foxes, dogs, wolves, great horned owls, and fishers. However, they are only a minor source of mortality. Malnutrition and harsh winter weather play a greater role than they do in limiting raccoon populations, especially juvenile animals.

Although some records show that raccoons may be long-lived in the wild, many animals succumb during the first year of life to disease, starvation, wild predators, and trappers. In some areas annual mortality rates for raccoon populations have been estimated at 50–60%.

Relationship with people

Because the raccoon can be easily tamed when young, many people have had their lives enriched by a close association with this intelligent, inquisitive animal. Males, however, may become aggressive as they mature and usually end up being returned to the wild. The raccoon is one of the few creatures that appears capable of making the adjustment from family pet back to wild animal.

For other people the raccoon is a wily and persistent pest. Raccoons often cause significant damage to agricultural crops such as corn and lesser damage in orchards, vineyards, melon patches, and poultry yards. They are considered undesirable in areas being managed for waterfowl or upland game birds because they destroy nests and eat young. In urban areas, considerable damage to residential roofs, garages, gardens, and lawns has been blamed on raccoons.

Often the only solution is to remove the offending animals by trapping or hunting. Problem animals are often livetrapped and moved to other localities. This practice, however, may contribute to disease transmission. Recent studies have shown that relocated raccoons travel extensive distances in short periods of time and are thus an ideal vehicle for transmitting contagious diseases such as rabies.

Habitat improvement for raccoons should include the provision of denning sites such as hollow trees and logs and the planting of crops such as corn as a source of food. However, in city areas little habitat management is needed because the raccoon adapts readily to human-made structures for shelter or sanctuary. Raccoon populations are thriving in most areas, and the species appears secure from any population decline in the foreseeable future.

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Published by Authority of the
 Minister of the Environment
 © Minister of Supply and Services
 Canada, 1989
 Catalogue No. CW69-4/47-1989E
 ISBN 0-662-17061-X
 Text: Richard C. Rosatte
 Photo: Robert McCaw

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Polar Bear



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Under a rising sun, polar bears, with their massive bodies and long necks, appear lemon yellow against the dazzling whiteness of their home — the arctic pack ice. As they walk steadily along the snow-drifted ridges of ice, usually into the wind, they sniff constantly, their sensitive noses testing the air for scent from the breathing holes hidden under the snow that ringed seals maintain in the sea ice through the winter.

Physical characteristics

Known to scientists as *Ursus maritimus*, which is Latin for “bear of the sea,” the polar bear is actually the largest land carnivore, or meat-eater. Adult males measure 240–260 cm in total length and usually weigh 400–600 kg, although they can weigh up to 800 kg, about as much as a small car. They do not reach their maximum size until they are 8–10 years old. Adult females are about half the size of males and reach adult size by their fifth or sixth year, when most weigh 150–250 kg. Pregnant females can weigh up to 400–500 kg just prior to entering their maternity dens in the fall.

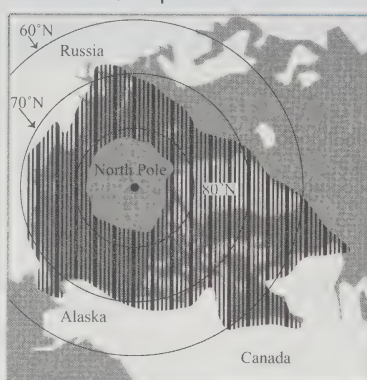
The bodies of polar bears are longer than the bodies of brown bears; their necks and skulls are also longer, but their ears are smaller. Instead of having the characteristic “dished” or concave facial profile of brown bears, polar bears possess a more prominent or “Roman” nose. Their canine teeth are large, and the grinding surfaces of their cheek teeth are jagged, which is an adaptation to a carnivorous diet. Polar bear claws are brownish in colour, short, fairly straight, sharply pointed, and non-retractable.

Adaptations to the Arctic

Polar bears are marvellously adapted to their arctic surroundings. Their thick winter coats, with glossy guard hairs and dense underfur, and the thick layer of fat beneath their skin protect them against the cold. The guard hairs also shed water easily, so that after a swim the polar bear can shake itself like a dog to decrease chilling and to dry itself fairly quickly. Polar bear hair is translucent and reflects the heat from the sun down to the base of the hair, where it is absorbed by the black skin.

The white colour of the polar bear also serves as camouflage. Polar bears are clever in their use of cover, be it land, water, or ice. This aids both their hunting of seals and their own escape from human

Distribution of the polar bear



hunters. The soles of the bears’ feet have small bumps and cavities that act like suction cups which help to keep them from slipping on the ice.

Probably the most significant adaptation of polar bears to the uncertainties of food availability in the Arctic is their ability to slow down their metabolism — in order to conserve energy — after 7–10 days of not being able to feed, for whatever reason and at any time of year, until food becomes available again. In comparison, black or brown bears can slow down their metabolism only in response to not feeding in the late fall, just before they enter their dens for the winter. If food is removed from black or brown bears in spring or summer when they are not in their winter dens, they will simply starve to death.

Physical capabilities

Hunting bears rely mainly on their keen sense of smell. They can detect seal breathing holes covered by layers of ice and snow 90 cm or more thick up to a kilometre away. Their eyesight and hearing are probably similar to those of a human.

Their normal gait is a slow, lumbering walk of about 5–6 km/h. They may gallop when chased, but they usually do not like to run for long. Although immature bears can run as far as 2 km, older bears tire quickly because they are fat and well insulated, which causes them to overheat fairly quickly.

When polar bears swim, they use their large front paws as powerful oars, while their rear paws trail behind and act like rudders. Underwater, they keep their eyes open. A polar bear may remain underwater for over a minute.

The polar bears’ large front paws are also useful for hunting seals. When the seal comes up to the breathing hole for air, the polar bear kills it and flips it out of the water with a single blow of its paw.

Distribution and abundance

Polar bears are most common along the coastal areas of the Arctic and the between-island channels of the various archipelagos, or groups of islands, in the Arctic (see map). Small numbers of bears enter the permanent pack ice that lies over the central polar basin, and some have been recorded as far north as 88°N latitude (the North Pole, which gives the “polar” bears their name, is at 90°N latitude). A few polar bears regularly appear as far south as Newfoundland, and they have occasionally been noted in the Gulf of St. Lawrence in years when heavy pack ice drifts farther to the south than normal.

One of the three largest maternity denning areas for polar bears in the world is in Canada, near Churchill, Manitoba, on the western coast of Hudson Bay. The other two are on Wrangel Island, in Russia, and in Kong Karls Land in Svalbard, Norway, in the Arctic Ocean.

The current world polar bear population is probably 25 000–30 000. The Canadian population likely exceeds 15 000.

Habitat and diet

Polar bears are considered to be marine mammals because they depend upon seals and the marine environment for their existence. They feed mostly on ringed seals, but they also catch bearded seals, harp seals, hooded seals, and harbour seals. Occasionally, they may also kill walruses, belugas or white whales, and narwhals.

Polar bears prefer areas of annual ice (which they use for a hunting platform and protective cover) interspersed with snow-drifted pressure ridges, refrozen cracks, and areas of open water, or polynyas. This habitat preference is closely linked to the presence of their favourite food, ringed seals. During the winter and spring, adult ringed seals maintain breathing holes in the fast ice by constantly scratching (or abrading) the ice with the heavy claws on their foreflippers. Younger seals are more abundant in areas where there is some open water during winter, such as adjacent to shore leads or polynyas, because it is easier to breathe there and they are able to avoid dominant

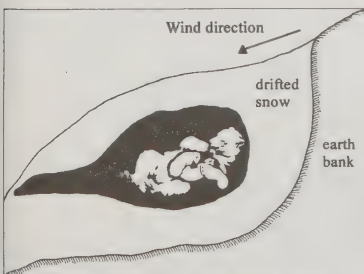
adult seals that are more abundant in the fast ice.

During April and May, polar bears, especially females accompanied by dependent cubs, hunt for newborn ringed seals, or *whitecoats*, in their birth lairs in the underside of the snowdrifts that cover the seals' breathing holes. After smashing into the lairs and killing the seals, the bears eat mainly the fat and skin, often leaving much of the meat for scavengers. Seal pups and their mothers constitute the main part of the spring diet of polar bears, except for the nursing cubs.

Besides hunting seals at breathing holes and birth lairs, bears stalk seals basking on land-fast ice or ice pans. During spring and early summer, when seals are most accessible, a bear may catch one every 4–5 days. They eat the fat as quickly as possible before another bear smells the kill and comes to compete for some of the carcass.

Polar bears in areas like the Beaufort Sea may remain on the ice throughout the year, even digging their maternity dens in snowdrifts on the ice. However, in areas such as eastern Baffin Island and Hudson Bay, most or all of the pack ice melts by mid- to late summer. This forces the whole bear population to come ashore for 2–4 months in summer and early fall to wait for the ice to freeze again. During this period, the bears can no longer hunt seals. As a result, they live mainly on their fat stores and conserve energy by remaining inactive most (over 80%) of the time. They will scavenge on carcasses if they find them, and they will occasionally eat grasses and berries, particularly polar bears that are not yet adults and females accompanied by dependent young. Bears have even been seen diving for seaweed and trying to catch seabirds sitting on the water by swimming underwater and coming up beneath them. Very few cases of bears killing and eating caribou or muskoxen are known.

Polar bear den in a snowdrift, the entrance covered by snow



Life history

Mating occurs in April and May, when polar bears are out on the pack ice hunting seals. However, the fertilized egg does not implant in the uterus and begin to grow until mid- September to mid-October. The young are born after about 2 months of gestation or pregnancy, from late November to early January, depending on latitude. The most common litter size is twins, followed by singletons. Triplets are born periodically, especially when feeding conditions have been good and the females are able to put on a lot of fat before denning; quadruplets have also been recorded, although this is extremely rare.

At birth, the cubs are only about 25 cm long and weigh less than a kilogram. Their eyes are closed at birth, and they are covered with hair so fine that in some early descriptions the cubs were reported to be hairless.

Although polar bears of both sexes and all ages may occupy temporary dens or shelters during periods of cold or stormy weather, only pregnant females remain in dens throughout the winter. Maternity denning through most of the Arctic begins about mid-October, when the pregnant females search for deep snowdrifts near the coast. Often they excavate their dens on the south-facing slopes of hills or valleys, where prevailing northerly winds pile up deep snowdrifts.

Dens vary in size, but the maternity denning chamber, at the upper end of an entrance tunnel 1–2 m long, averages about 1.5 m in diameter and 90–100 cm high in the middle. The opening to the entrance tunnel is sealed with drifted snow shortly after the female excavates her den. The chamber is higher than the entrance tunnel, trapping any warmer air from the bears there. As a result, when the den is occupied, the inside temperature remains only a few degrees below 0°C throughout the winter, regardless of how cold the outside air temperature becomes.

Most family groups in lower Hudson Bay break out of their dens between late February and mid-March, whereas those in the High Arctic exit up to a month later. The family remains at the den site for 1–2 weeks, getting used to the cold and exercising. If the subsequent journey to the sea ice is more than a few kilometres, the females may stop two or three times a day to rest, feed the cubs, and warm them. Once back on the sea ice and hunting continuously, the female periodically digs resting pits in the snow, sheltered from the prevailing wind, where she nurses the cubs and where they can all sleep.

The family group breaks up when the cubs are about 2.5 years old. Occasionally, cubs remain with their mothers until they are 3.5 years old, and in western Hudson Bay, some mothers wean, or stop nursing, their cubs at only 1.5 years of age. The most difficult time in a polar bear's life is probably its first year of independence, because it is still learning to hunt proficiently, and, when it does successfully catch a seal, it is likely to have it taken away by larger bears.

Males and females become sexually mature when they are 4 or 5 years old. Although the females may mate then and produce cubs, it is unlikely that many males breed until they are 8–10 years old. Because cubs usually stay with their mothers for 2.5 years, the most often a female is normally capable of having a litter is every 3 years. This is a very slow breeding rate, which explains why depleted populations take so long to recover.

Male polar bears commonly live up to about 25 years of age, and females often live into their late twenties. In captivity, one female lived to be over 40, but living for more than 30 years in the wild is uncommon.

Interactions with humans and other predators

Walrus and wolves have been known to kill polar bears, but this is unusual. Adult males occasionally kill cubs, but this probably does not occur often.

The human hunter is the primary predator of the polar bear. In recent years, hunters throughout the world have killed fewer than 1000 yearly. Between 500 and 600 of these are taken by Inuit and Amerindian hunters in Canada under a system of annual quotas that is reviewed annually in Nunavut, the Northwest Territories, Yukon, Ontario, Manitoba, Quebec, and Newfoundland/Labrador.

Polar bears will usually not attack humans except to protect their cubs or because they are starving.

Economic value

Untanned polar bear pelts sell for \$500–3,000, depending on their size and quality. This can make up a significant portion of an Inuk hunter's cash income. Within the annual quota assigned to each coastal village in the Northwest Territories and Nunavut, hunters are also allowed to allocate a number of hunting tags to

non-resident sport hunters, who are guided on a polar bear hunt by local Inuit hunters for fees that are normally in the range of \$18,000–20,000 per hunt. This is an important source of cash income for small settlements in northern Canada. The annual economic value of the guided sport hunt and the hides is about \$1 million in Canada.

Because the tags from unsuccessful guided sport hunts cannot be reallocated to different hunters, one consequence of that practice is that fewer bears are killed in total than would be the case if all the tags were allocated to subsistence hunters, or hunters who hunt in order to provide food for their families. Also, because most sport hunters seek large males, fewer adult females are killed overall, which provides some additional protection for the reproductive component of the population.

Polar bears are also highly valued as display animals in zoos and are one of the central attractions of the famous Moscow circus.

Bear meat may be eaten by humans and is often used as dog food. However, polar bear meat is sometimes infected with trichinosis, so it should be cooked thoroughly before being eaten. Polar bear liver can also be dangerous to humans and dogs because of its high vitamin A concentration.

Conservation

Although polar bears are not in immediate danger of extinction, they face threats common to all large predators: human encroachment on their habitat, illegal hunting, and chemical contaminants in their prey. A new threat appears to be global warming or climate change, which is affecting the polar bear's habitat by reducing the total ice cover in the Arctic, thinning the permanent pack ice of the central polar basin, and changing the timing of freeze-up and breakup in more southerly areas, such as Hudson Bay. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has designated the polar bear as a species of special concern in Canada.

The Canadian Wildlife Service has been studying the ecology of polar bears since 1961. This research project, which continues today, provides information on population size, growth rates, reproduction rates, movements, levels of toxic chemical contamination, and the effects of long-term climatic and ecological change. The Canadian Wildlife Service is also represented on two permanent national polar

bear committees (one comprising scientists and the other senior administrators), each of which meets annually to review new research results and management problems within Canada.

Conservation of polar bears requires international cooperation, as several populations are shared between countries and as problems such as contaminants and climatic change are affecting the whole Arctic. Since 1965, an international group of scientists specializing in studying polar bears has been coordinating research and management of polar bears throughout the Arctic under the auspices of the International Union for Conservation of Nature and Natural Resources (IUCN), also known as the World Conservation Union. Five countries — Canada, Denmark, Norway, the United States, and the U.S.S.R. — signed an International Agreement on the Conservation of Polar Bears in Oslo, Norway, in 1973. The agreement came into effect in 1976. The Canadian Wildlife Service is represented on the IUCN/Species Survival Commission (SSC) Polar Bear Specialists Group, which meets every 3–4 years and provides advice to the IUCN and to the nations that signed the Polar Bear Agreement on international aspects of research and conservation.

At present, the polar bear is one of the best managed of the large arctic mammals. If all the arctic nations continue to abide by the terms and intent of the Polar Bear Agreement, the future of this magnificent species should be secure.

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The Canadian Wildlife Service

The Canadian Wildlife Service of Environment Canada handles wildlife matters that are the responsibility of the Canadian government. These include protection and management of migratory birds as well as nationally significant wildlife habitat. Other responsibilities are endangered species, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

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Également disponible en français sous le titre *L'ours blanc*.

Published by authority of the Minister of the Environment
©Minister of Public Works and Government Services Canada, 2002
Catalogue number CW69-4/18-2002E
ISBN 0-662-31150-7
Text: I. Stirling
Photo: Bev McMullen
Sketch: Wendy Kramer

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Red-breasted Nuthatch



The Red-breasted Nuthatch (*Sitta canadensis*) gets a special view of things by looking at the world upside down. This bird, and the 16 other known nuthatch species, are able to descend head downwards on tree trunks and branches. Thus they search in nooks and crannies in bark for tiny organisms overlooked by other birds which glean food while moving in an upright fashion. A greatly enlarged hind toe and a stubby tail are probably both adaptations for climbing downwards; the toe provides secure footing, and a long, floppy tail could get in the way. The Red-breasted Nuthatch lives mostly on the branches of trees instead of on the trunks, and in this way resembles a chickadee.

All of the 17 species of true nuthatches of North America and Eurasia belong to the genus *Sitta*; these comprise the common nuthatch family or Sittidae. None are more than seven and one-half inches long. Whether in Formosa, Germany or Mexico, all nuthatches share many characteristics with the Red-breasted Nuthatch. Several Eurasian species, however, differ primarily in that they live on cliffs foraging on rocks rather than on trees — hence rock nuthatch (*Sitta neumayer*).

Description

Like all nuthatches the Red-breasted Nuthatch has short legs, a flat body, and a large head. Its strong, rather long bill is slightly upturned. The Red-breasted Nuthatch can be distinguished from other nuthatches by a pronounced white eyebrow stripe set off by a black line through the eye, and black on top of the head and neck. The crown is black in the male and dark greyish-blue in the female. The back, wings, and tail are mostly greyish-blue in both male and female. The rusty-coloured underparts that give this species its name are paler in the female. The long and pointed wings when folded extend nearly to the tip of the short tail. The bird's overall length is about four and one-half inches. Its high-pitched

nasal yank-yank is often heard long before the bird itself is seen, for its habit of creeping mouse-like along limbs makes it easily overlooked. An exceedingly active bird, the Red-breasted Nuthatch moves rapidly from one tree to the next, in an undulating flight. The name "nuthatch" derived from "nut-hack", a reference to the habit especially in the European Nuthatch (*Sitta europaea*), of hacking or pecking open nuts. It wedges hard-shelled nuts, such as hazelnuts, and other hard seeds in a bark crevice and then hammers them with its bill.

Originally called *Le Torche-pot du Canada*, the Red-breasted Nuthatch is familiar to most North American bird watchers. Its present name in French is *La Sittelle à poitrine rousse*, a literal translation of its standard English name. It has been locally called "upside-down bird" (Newfoundland), "tomtit" (Nova Scotia), "cardy bird" (New Brunswick) and "little quank" (Ontario). Doubtless there are other pet names for this widely distributed species.

Distribution

The Red-breasted Nuthatch's breeding range covers much of the boreal forest region from Alaska to Newfoundland, south through the Appalachians to eastern Tennessee and North Carolina. It also occurs in the western coniferous forests south to California and Arizona. Although largely a permanent resident, some move southward each winter. Occasionally large numbers move south of the forests, and sometimes appear in open country where they may have to search for food on tall weeds. In 1961, for example, large numbers appeared as early as August, moving across the prairies south to the edge of the coast of the Gulf of Mexico and even down to the Florida peninsula. Thus in many areas it appears only occasionally as a winter visitant or migrant. Some observers think that the parents stay in the breeding areas throughout the year and that the small flocks seen in autumn are young of the year. Migrants return to Canada in April, often appearing in company with early migrant warblers.

Two of the other three nuthatch species found in North America also occur in Canada, the Pygmy Nuthatch (*Sitta pygmaea*) in southern British Columbia and the larger White-breasted Nuthatch (*Sitta carolinensis*) mainly in the eastern hardwood forest. The Brown-headed Nuthatch (*Sitta pusilla*) breeds only in the southeastern United States.

Food

The Red-breasted Nuthatch inhabits mixed-w and coniferous regions, preferring spruce-fir forests. The seeds of conifers make up a large part of its winter diet. It pries open the scales of cones with its strong bill and extracts the winged seeds, which it eats after discarding the wing.

■ Breeding range
||||| Wintering range



Following a year of low cone production there will be an early southward movement of nuthatches, crossbills and other birds that depend upon the cone crop. The Red-breasted Nuthatch seems to attain higher populations in the Great Smoky Mountains of Tennessee than in northern Ontario, up to 20 birds per 100 acres being recorded in the former area compared to three to eight birds per 100 acres in Canada.

Insects, insect eggs and larvae, and spiders and their eggs are also important in the nuthatch's diet. These birds feed on several forest insect pests. In western fruit orchards they eat an insect pest called the pear psylla; it has thus been recommended that nuthatches be encouraged in pear orchards by erecting bird houses for them.

Chopped nuts, seeds and suet readily attract nuthatches to feeding trays in winter, and the birds often hoard this food, stuffing it in crevices in the bark of nearby trees. This habit, found in several northern species, probably helps birds survive shortages in mid winter. The Red-breasted Nuthatch is aggressive and competitive at feeding trays, where it often becomes rather tame.

Courtship

In spring, Red-breasted Nuthatches practise courtship behaviour, which may be initiated by the female. One observer watched the female fly toward a male, displacing him several times, then she "pointed her bill rhythmically from side to side and lifted her wings high vertically above her back, flapping them up and down in time with the movements of her bill." This couple soon afterwards engaged in courtship feeding, the female begging food from the male by "pivoting slowly from side to side like an electric fan in action, while she pointed her bill toward him and flapped her wings as she answered him with ... soft notes: *Tetetetete*."

Courtship display between male and female helps the pair achieve co-ordination of their sexual cycles in order to hatch and rear their young when food is most readily available. Locating a territory, finding a mate, constructing a nest and rearing the young must be accomplished within a certain period. Building a nest may in itself be a considerable feat. One pair of European Nuthatches, for example, lined their nest with 6,695 fragments from birch and pine trees, of which the nearest were 45 and 75 yards away, respectively. The number of feeding trips per day for a pair with a nestful of six young varied from 119, two days after hatching, to 353 trips per day 18 days after hatching. The Red-breasted Nuthatch is even smaller than the European Nuthatch and presumably works just as hard to feed its young. The pair bond formed to permit mating keeps the male and female together throughout the arduous activities of rearing the brood.

Nesting and young

Both sexes usually excavate the Nuthatch's nest cavity in a decayed tree or stump, though they also use existing holes and occasionally nest in bird boxes. A variety of living and dead trees, deciduous as well as coniferous, are used. Although Red-breasted Nuthatches are characteristic inhabitants of coniferous forests, they also forage in deciduous trees and sometimes nest at a considerable distance from conifers. The nest height varies from 2 to 120 feet, most nests being found about 15 feet above ground. The cavity is about eight inches in depth and is lined with soft material such as shredded bark, grasses, rootlets and, often, hair. The cavity entrance is invariably smeared with spruce or pine pitch brought by both male and female in their bills, often from some distance. Pitch is carried to the nest from the beginning of nest building until the young have left the nest. The function of this peculiar habit, which often results in both adults being soiled with pitch before the young have fledged (taken to wing), is unknown. This behaviour may be related to the habits of several eastern hemisphere nuthatch species which use mud to reduce the size of the entrance to their nest cavity. Certain species even construct an entire nest of mud, with a tubular, spout-like entrance. The large mud nest of the Rock Nuthatch may weigh up to 950 times the weight of one bird.

Red-breasted Nuthatch eggs are pure white spotted with reddish-brown, and are less than three-fourths of an inch long. The female lays from four to seven eggs and incubation takes 12 days. The young are fed a variety of insects and other invertebrates. The adults not only seek food on tree branches but also readily capture flying insects, showing that even a bird strongly adapted to one kind of feeding may be flexible in behaviour.

One observer of a Red-breasted Nuthatch nest reported that the male came regularly at about 10-minute intervals with a bill full of large-winged diptera (two-winged flies). The young are fed in the nest for two to three weeks before they fledge, and stay with their parents in a noisy family group for several weeks thereafter.

Voice

Red-breasted Nuthatches, scrambling and fluttering about among the cones and needle-tufts at the ends of branches, constantly utter a series of weak nasal notes, more highly pitched and rapidly uttered than those of the White-breasted Nuthatch. Author W. M. Tyler notes that "when a little company is feeding together they keep up a cheery chatter among themselves. We find them at their best when gathered in the northern forests at the close of summer. Then they give their high, tin-whistle note, *kng*, back and forth on all sorts of pitches, varying its inflection, ringing unheard of changes on this simple call, and when they are



together thus, they use also a squealing note — a very high, nasal, little piglike or mouselike squeal — and a short explosive *kick*, or a rapid series of *kicks*." Also among the Red-breasted Nuthatch's variety of surprisingly expressive sounds is a territorial song, a prolonged series of monotonous nasal notes: *yna-yna-yna* or *yaaaaa*.

This little bird plays a useful role in keeping insect pests under control, and is a welcome addition to bird feeding stations. May its "tiny tin horn" long be a familiar sound of our northern forests.

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Red fox. Credit National Film Board

Red fox

(Vulpes vulpes)

The red fox is one of Canada's most wide-spread species. It is found in all provinces and territories, but is absent from most of the Arctic Archipelago, the coast of British Columbia, and Vancouver Island, although escapeses from fur farms served to introduce the species to that island in this century. This almost country-wide distribution reflects the red fox's adaptability to its environment and its ability to survive on a varied animal and vegetable diet.

Appearance and colouration

The red fox is a small carnivore with an agile and lightly built frame, and belongs to the same family (Canidae) as the dog, coyote, and wolf. It is distinctive for its coat of long lustrous fur, and its relatively large and bushy

brush (or tail) and ruff. A typical male fox weighs about 12 pounds and stands about 14 inches at the shoulder, while the vixen is usually slightly smaller. Unfortunately, the name "red fox" does not describe the colour of all the members of this species. The red fox is a "polytypic" species, that is, a species in which there are several possible colour schemes, some of which may occur within a single litter. The human animal is similar, in that our natural hair colour can vary from blond to black within any interbreeding population.

Common colours for the red fox are "red", "cross", "black", and "silver". The basic colour is "red", in which the individual is red or reddish all over except for a faint brown "cross" on the saddle, black paws, black behind the ears, a black muzzle, white or lighter underside and throat, a white tip to the tail, and perhaps white stockings. The body colour of the "cross" fox is browner or darker than that of the "red", and it has a dark brown or black "cross". The "black" fox is black all over. These two colour patterns are the two extremes of variation possible from the "red" phase. The "silver" phase has a black coat with white-tipped fur and, although it occurs in the wild, was selectively bred by fur farmers during the heyday of fox-fur as an item of woman's apparel.

Diet

The red fox is classified as a carnivore because it prefers to eat animal matter, chiefly mice and other small mammals, frogs and insects when in season, and perhaps occasionally a young bird that has fallen from the nest, or the egg of a ground-nesting bird. Investigations of the stomach contents of many hundreds of red foxes in both Canada and the United States have shown that small rodents, such as deer mice and meadow and red-backed voles, make up over 90 per cent of the animal's diet. In times of scarcity the red fox may feed on carrion and, if no flesh is available, on fresh and frozen fruit, such as wild apples, hawthorn or wild rose haws, wild grapes, blueberries, etc. There are reports of foxes making caches of food by burying the uneaten portion of a carcass, but such activity appears to be rare, or at least rarely observed by man, and may be characteristic of individuals rather than the whole population.



Range of red fox

Habitat

The red fox in Canada has successfully adapted to the European agricultural systems introduced by settlers over the last three hundred years. It is possibly one of the largest indigenous animals to have become so adept at living in our farming areas, another being an even more omnivorous carnivore, the raccoon (*Procyon lotor*).

It is thought that there are more red foxes alive today in North America than ever before. This came about because the spread of the European settlers and their farms introduced an environment with both trees for cover and open fields for hunting areas. Since the red fox does not compete directly with our agricultural activities for its living, and, in fact, helps most farmers by keeping down the smaller rodents, it should be a welcome animal. However, the red fox has been given the bad name of a poultry thief, and it must be admitted that an occasional individual will take to chicken-stealing, especially if food is scarce, the chickens are not properly penned, and the fox is old or somehow incapacitated for making a living in the wild. Most red foxes, though, interfere neither with our poultry nor our game birds to any appreciable extent.

Distribution

The original habitat of the red fox appears to have been the northern mixed hardwood and softwood forest zones. Undoubtedly, some red foxes occurred both south of this zone in the true hardwood forest, and north in the southern fringes of the tundra, but both these regions were already occupied by foxes – the grey fox (*Urocyon cinereoargenteus*) in the south and the arctic fox (*Alopex lagopus*) in the north. With the cutting of much of the hardwood forest and its replacement by farmlands interspersed with wood lots, fences, avenues, cut-over scrub, etc., the tree-loving grey fox has been replaced by the red fox, and in this century the red fox has penetrated as far south as Texas and Florida. At the same time, the red fox has invaded the tundras and is now to be found over most of mainland Canada and has even been reported from Southampton Island and Baffin Island.

Origin

Because the first permanent European settlers on the North American continent landed in what is now Virginia, where the common fox was the grey fox, it was for a time doubted that the red fox was native to North America. This confusion was further compounded by Colonial gentlemen of the seventeenth and eighteenth centuries introducing European red foxes from France and England to the central Atlantic coastal colonies for the purpose of fox-hunting on horseback and with hounds. These introductions were undertaken because the grey fox climbs trees and will run along the tops of walls and fences when chased, while the red fox stays on the ground and thus can be followed by the hounds. However, the red fox is naturally indigenous to North America and remains have been found by many archaeologists from Indian middens (or refuse heaps) dating back to 2,000 B.C. and by palaeontologists from still further in the past.

Relationship to the European red fox

At one time, taxonomists thought that the North American red fox was a different species from the European red fox, mainly because the smaller European southerly form was compared with the larger North American northerly form. The size differences, added to the separation of the populations by

the Atlantic Ocean, were considered conclusive evidence that they comprised separate species. At the time this was accepted, knowledge of Asiatic Russia and especially of Siberia was incomplete, but now it has been demonstrated that the red fox is a holarctic animal, that is, it is distributed on all the circumpolar northern lands with suitable environment, and there are no real gaps or breaks in this continuous population that might suggest there is more than one species of red fox.

Behaviour

The fox has been called sly, cunning, and crafty, all epithets that suggest a deceitful nature. In fact the fox is intelligent, and loyal to its mate and cubs. The fox's intelligence has often exasperated men, and this is possibly the reason for its bad reputation. The dog fox and vixen are thought to pair for life and occupy the same home range with a diameter of perhaps one mile, although the size of the range depends upon the available food supply. The pair may separate for periods during the winter, especially if the hunting is poor, but will come together for breeding and denning.

Denning and breeding habits

After pairing for breeding in January or February, the red foxes seek a suitable den. This is frequently the discarded burrow of a ground hog, skunk, or ground squirrel, or a convenient shallow cave, hollow tree, or patch of dense bush. The vixen enlarges or alters it to suit her needs and those of the expected litter. The den has one or more entrances, usually about ten inches in diameter. It is often situated on a south-facing slope with a clear space in front of it, where the cubs can play while the vixen watches over them. In dens in earth, the parents usually line the chamber with dry material, such as grass or other leaves, to insulate the newly born cubs from dampness and cold. The young cubs are born in early April or late March and number about seven to a litter. The cubs live in the den until they are about three months old, when the den is abandoned by the adults, and the young foxes become less dependent on their parents, usually in June or July.

The den is therefore mainly an early summer refuge for the parent foxes and for the

cubs until they can begin to take care of themselves. During late summer, the parents finish the training of the cubs and by autumn the cubs leave the parents forever and go their individual ways. From autumn until March of the next year, the foxes bed down in thickets and heavy bush, even during the coldest winter weather. The young foxes that survive the first winter will produce a litter the following March.

The cubs

The vixen takes great care of the very young cubs before their eyes are open and at this stage usually keeps the dog fox from entering the den, although he will hunt for them. After the cubs' eyes are open and they begin to crawl, the dog fox will relieve the vixen while she goes hunting. As the cubs are being weaned, both parents will hunt for themselves and will bring back small game for the cubs to play with. This play results in the cubs learning the smell of the game and eventually how to eat it. The last stage for the cubs is that of being trained to hunt. They may have to remain quiet and watch while the parent stalks a mouse in the long grass and later practice this under the parents' eye.

Hunting

A fox hunts by smell, sight, and sound as do most dogs. Its sight is good, and the slight movement of an ear may be all that the fox needs to locate a hidden rabbit. Their sense of smell is excellent, and they can smell hidden nests of young rabbits or eggs covered by long grass. A fox will wait patiently for the sound of a mouse moving along its covered path beneath the ground or in grass or snow and then pounce, or dig quickly to the source of the sound and locate the prey by its scent.

Enemies

The fox's chief enemy is probably man. Other enemies are the larger dog-like carnivores (wolves, coyotes, dogs), which will usually chase and kill it whenever the opportunity presents itself, the larger cats (lynx, bobcat, and perhaps the puma), which are the mortal enemies of any dog-like carnivore smaller than themselves, and occasionally the bear or wolverine, which may kill a fox if it cannot escape. Some accounts of foxes being attacked by large birds of prey, such as eagles

or owls, are recorded, but they appear to be unusual. The fox usually eludes its larger enemies by running away. If flight alone does not provide the escape, then the fox goes to ground in its den or in a thicket or hollow log. Only in the last extremity will the fox turn to fight when the enemy is more powerful or more numerous.

Management

Many provinces have placed bounties on various animals that in some way are considered noxious, and the red fox has been included among them. The effectiveness of control of the red fox population by this method is dubious. If one considers that a breeding pair of red foxes has litters of seven cubs and that an individual may reach eight years of age, of which perhaps six may be productive years, it can be calculated that each breeding pair may produce some 42 live births should the pair survive the full eight years. In order to replace the parents when they die and thus ensure a stable population, only 2 of these 42 need reach full maturity and die of old age. The remaining 40 (95 per cent) will die without finding a suitable territory in which to survive and breed. Most cubs die the first year from disease or because they are not sufficiently skilled to avoid the many dangers which threaten them. It seems that much of the effort at control is expended to remove young animals that would die from natural causes anyway.

Rabies

Rabies is a disease that afflicts many small carnivorous mammals such as skunks, raccoons, cats, dogs, and even bats. A disastrous plague of rabies so reduced the red fox population in Canada during 1955-62 that it became quite unusual to see a red fox. Today the population is increasing and red foxes are again being observed by hunters, trappers, and farmers. Early symptoms of rabies are loss of fear of man and roaming in daytime. Foaming at the lips, possibly with blood in the foam, shows a late stage of the disease. A rabid fox may bite livestock or people. If the latter occurs, it is best to shoot the animal and have it tested for rabies immediately. Treatment for rabies is painful but effective if administered in time.

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How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

Each province has control over the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Migratory Birds Convention Act and Regulations for the federal government. In practice, federal and provincial governments co-operate in all matters concerning migratory birds. The Canadian Wildlife Service studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's National Parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a pesticide investigator, and a biometrician. The head office is in Ottawa and there are regional offices in Edmonton and Ottawa. Smaller offices are located at Fort Smith and Inuvik, Northwest Territories; Whitehorse, Yukon Territory; Vancouver, British Columbia; Calgary, Alberta; Saskatoon, Saskatchewan; Winnipeg, Manitoba; Aurora, Ontario; Ste-Foy, Quebec; Fredericton and Sackville, New Brunswick; Halifax,

Nova Scotia; and St. John's, Newfoundland.

The Service administers 94 migratory bird sanctuaries throughout Canada. It is now participating with the provinces in a major program of preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program was announced on April 6, 1966, that provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province please contact your chief provincial game officer.

Additional notes

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Roseate Tern



Endangered in
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Buzzling white against the indigo blue of the sky, a delicate bird with streaming tail feathers speeds into the rippling sea. Seconds later, it surfaces triumphantly with a small, silvery fish wriggling in its bill. Again and again, the elegant Roseate Tern (*Sterna dougallii*) “flies” into shallow nearshore waters in search of sand lance, its favorite prey.

The graceful flight and harsh cries of Common (*Sterna hirundo*) and Arctic (*Sterna paradisaea*) terns are part of summer on the beaches of eastern Canada. But there are few opportunities to observe the plunging high dive of the Roseate Tern, and there may be even fewer in the future. Since the 1950s the North American population of Roseates has declined steadily to the point where the Canadian birds are considered “endangered” by the Committee on the Status of Endangered Wildlife in Canada.* The U.S. Fish and Wildlife Service (USFWS) has designated Roseates that breed in the northeastern United States “endangered” as well. A Roseate population close to North America, the Caribbean breeding population, has also declined and the USFWS lists it as “threatened.”

Description

The Roseate Tern is a seabird that resembles a small gull, but it has the typically slender body, short legs, and long, pointed wings of all terns. It is closely related to Common and Arctic terns and is frequently found in company with them, so it is not easy to identify (see drawings). Roseates are a paler grey than Arctic and Common terns, and their tail streamers are considerably longer.

The adult Roseate Tern is 33–34 cm in length and has a wingspan of 72–80 cm. At a weight of approximately 100–120 g, an adult is slightly smaller than a Mourning Dove. It has a

black forehead and nape, and its upper wing is a pale grey. Its tail is white with deeply forked outer feathers that give the impression of long streamers when the bird is in flight. The underside of the tern is white, tinged with pink early in the breeding season; however, this pale rosy tint is not a good field mark because it varies from bird to bird and the colour tends to be bleached out by the sun. The legs and feet are reddish, and the bill is mostly black, although bills of breeding birds may be red at the base. Male and female birds look alike. The head of the nonbreeding adult is mottled black and white.

The juvenile Roseate Tern has a mottled greyish back and rump and dark bill and legs. Chicks are unevenly covered with down, giving them a spiky appearance; their legs are dark purplish to black. All terns have a harsh cry, but the Roseate Tern has a distinctive, two-syllable call — “kir-rick” — that is often the best way of confirming its presence at a colony.

Range and abundance

With a total world population of about 50 000 pairs, the Roseate Tern is not considered endangered globally. It breeds on coasts and islands in the tropics along the Indian, Pacific, and Atlantic oceans and in temperate zones of North

America and Europe, South Africa, and western Australia. Roseates are nowhere abundant and have suffered major declines in all parts of the world. This text

focuses on the North American breeding population.

No one knows how many Roseates nested in North America prior to the end of the 19th century. Early reports say only “thousands.” We

know that when the species was being hunted in the 1890s (because its elegant tail feathers were in demand for use on hats), there were only 2000 pairs.

With protective legislation, the North American population of Roseates grew by the 1930s to 8500 pairs: they nested in scattered colonies along the eastern seaboard as far south as South Carolina. Since the 1950s, due to loss of nesting habitat, predation, and trapping on the wintering grounds, the total has fallen to 3800 pairs, and the colonies now extend only as far south as Long Island in New York.

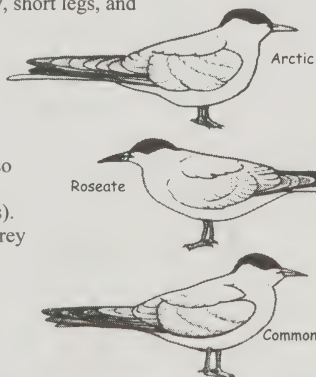
Only 3% of the population breeds in Canada, which is at the northern limit of their breeding range. Today the Canadian breeding birds are estimated at fewer than 140 pairs, concentrated on a few islands off the Atlantic coast of Nova Scotia. Small numbers nest on the Îles-de-la-Madeleine, and a pair occasionally nests on Machias Seal Island, which is a migratory bird sanctuary, in the Bay of Fundy. A few nest on Sable Island.

Migration cycle

Adult North American Roseate Terns return from their wintering grounds (see map) to reach their breeding colonies during May. They leave the colonies shortly after their young have fledged. In late July, they begin moving to staging areas such as Sable Island (Nova Scotia), Cape Cod (Massachusetts), and Long Island (New York), migrating a few weeks later to their wintering grounds off the coasts of South America. Recoveries of banded birds reveal that some are found in Guyana in November and December; however, it is unclear where they spend January to April. Recently, some have been found in eastern Brazil. There is speculation that they may go to sea and become pelagic. (A bird that is pelagic lives on the open ocean without coming ashore.) Evidence suggests that immature birds remain in the south during their first “summer.” Many two-year-olds return to the nesting colony, and although a few of these may breed, most young Roseates wait until they are three or four.

Breeding biology

After Roseate Terns arrive in their breeding colonies in early to mid-May, the pairs begin courtship displays. These displays include an elaborate, ritualized flight in which the male, often carrying a fish, ascends in circles high into the air, closely followed by one or more females; the male and the lead female descend together in a zig-zag glide. Courtship feeding — the presentation of fish to the female by the male — helps compensate



*Levels of endangerment assigned by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC):

EXTINCT species no longer exist.

EXTIRPATED species no longer exist in the wild in Canada, but they occur elsewhere.

ENDANGERED species face imminent extirpation or extinction.

THREATENED species are likely to become endangered if limiting factors are not reversed.

VULNERABLE species (or populations) are of special concern because of characteristics that make them particularly sensitive to human activities or natural events.

the female for the energy used in egg production.

Roseate Terns nest close to other terns, to take advantage of the benefits of living within a colony. All species of terns join together to threaten and mob invading predators. Roseate Terns often choose nesting sites that provide cover and usually hide their nests under dense grasses and other plants, boulders, or washed-up debris. The nests are not much more than a bare scrape in sand or rubble.

The birds begin laying eggs by late May. The usual clutch contains one or two eggs laid two to three days apart, and incubation begins when the clutch is complete. The parents take turns incubating the eggs for 23–24 days. After the chicks hatch, they stay near the nest area where they are guarded and fed by both parents. Several days later, the chicks leave the nest to find new hiding places. Although some parents are able to raise two chicks to fledging, the second chick usually starves because the adults, who must sometimes fly long distances to forage, cannot provide enough food for both. Chicks fledge 25–28 days after hatching and leave the colony with their parents within a few days. They are tended by their parents for at least six weeks after fledging, while they learn to fish on their own.

Food and feeding

Roseate Terns feed in salt water on small fish, most frequently sand lance but also white hake, juvenile herring, mackerel, gadids, cod, pollock, and haddock. They dive into the water to catch their prey and can immerse themselves completely and “fly” under water short distances in pursuit of fish. They prefer to fish in rips and other turbulent waters and will forage as far as 20 km from their colony. The birds usually carry one fish at a time in their bills but occasionally will carry more. They will steal fish from other terns and are often the victims of similar piracy by gulls and even crows and ravens.

Threats and conservation

Although Roseates hide their nests and young, they are still subject to losses from gull, crow, and raven predation. The explosion in gull populations during the 20th century has created a twofold problem for the Roseate Tern. First, some individual gulls specialize in preying on terns and will take eggs, chicks, fledglings, and even adults. Second, gulls take over

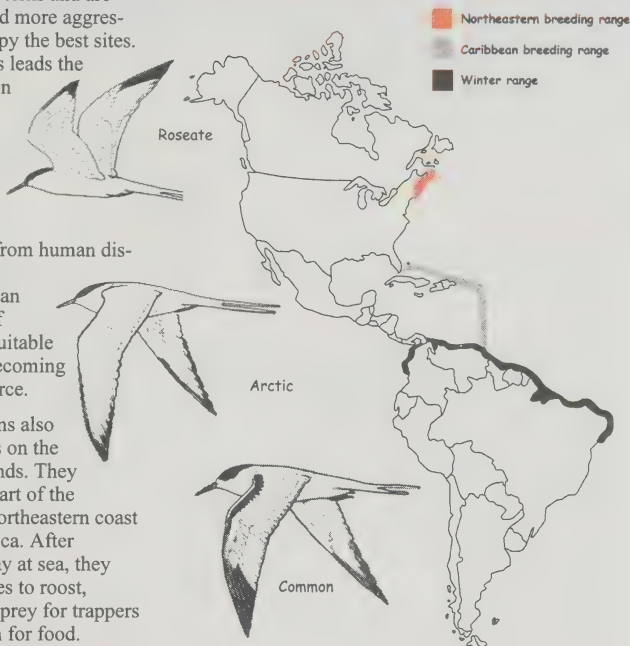
colonies established by terns. Because gulls start their nests earlier than the terns and are much larger and more aggressive, they occupy the best sites. Frequently, this leads the terns to abandon their colony in search of new locations, preferably near-shore islets and other places remote from human disturbance. With increasing human development of coastal areas, suitable locations are becoming much more scarce.

Roseate Terns also face difficulties on the wintering grounds. They spend at least part of the winter on the northeastern coast of South America. After spending the day at sea, they return to beaches to roost, becoming easy prey for trappers who catch them for food. Although trapping is being discouraged by South American biologists and governments, it remains a cause of mortality. In Canada this practice has been illegal since 1917: Roseates and other terns are protected under the *Migratory Birds Convention Act*, which makes it illegal to capture, kill, or take individuals, nests, or eggs.

In North America, the Roseate Tern population is concentrated in a relatively small number of nesting colonies. Consequently, any declines in the fish stocks that it feeds on — for example, due to commercial fishing, chemical pollution, or oil spills — could have disastrous results. The species is also vulnerable to direct disturbances, such as human activity near colonies, ecotourism, eggging, netting of adults, and domestic and introduced predators.

In Canada, it is important to continue to eliminate open municipal dumps and to stop disposing of fish wastes from fishing vessels and factories: such dumps and disposal have contributed to the gull population explosion in the last half of this century. People who live near or use the sea for work or pleasure must take care to protect the terns and their habitat from contamination. They must also respect the privacy needed by terns and other bird species at their breeding colonies.

The map shows the distribution of the North American and Caribbean populations of the Roseate Tern.



Protection of tern nesting colonies is critically important to the survival of Roseates. Because Roseates always nest with other terns, colonies of Common and Arctic terns must be protected as well. The Nova Scotia Department of Natural Resources has established wildlife management areas at two colonies, and protection options are being explored jointly by provincial biologists and the Canadian Wildlife Service (CWS) of Environment Canada for another major Roseate Tern colony. Strict protection is provided for birds nesting within wildlife management areas and migratory bird sanctuaries. As well, gulls, crows, and ravens must be discouraged from nesting on islands with colonies of Roseate Terns. CWS and some partners have begun to explore the use of various nonlethal control measures to create and maintain “gull-free” islands.

Wildlife biologists are optimistic about the future of the Roseate Tern in Canada. Their optimism is grounded partly in the success of colony management in the U.S., with its much larger share of the Roseate population. Their optimism is also based on the detailed plan that RENEW, a committee made up of representatives of Canadian government and non-government wildlife organizations, now has in place to rescue the Canadian-breeding birds. Recovery strategies

include maintaining productivity levels at more than one fledgling per pair per year, having a sufficient number of predator-free breeding sites for the terns, reducing abnormally high gull populations by reducing the amount of food available to them from dumps and fishery wastes, and promoting the protection of terns on their winter range.

Reading list

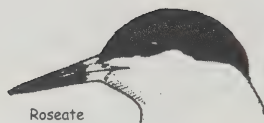
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Roseate



Common



Arctic

The Canadian Wildlife Service

The Canadian Wildlife Service handles wildlife matters that are the responsibility of the Canadian government. These include protection and management of migratory birds as well as nationally significant wildlife habitat. Other responsibilities are endangered species, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

For more information about the Canadian Wildlife Service or its other publications, please contact:

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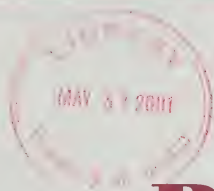


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Également disponible en français sous le titre
Sterne de Dougall.

Published by authority of the
Minister of the Environment
© Minister of Public Works and
Government Services Canada, 1999
Catalogue number CW69-4/99-1999E
ISBN 0-662-28194-2
Text: L. Calkins and D. Amirault
Drawings: Judie Shore
Photo: Scott Hecker

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-H38



Peregrine Falcon



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Renowned for its speed, grace, and beauty, as well as its rapacity, the noble Peregrine Falcon *Falco peregrinus* has been the prized favourite of falconers for over 3 000 years, ever since the nomads of central Asia first pursued game with trained hawks and falcons.

The name peregrine, from the Latin adjective *peregrinus*, means “coming from foreign parts” or “wanderer.” The peregrine was so named as a result of the lengthy migrations of some populations.

Appearance

The falcons, with five species in Canada, are distinguished from other birds of prey by a toothlike projection near the tip of the upper half of the beak. Generally smaller and more streamlined than the hawks, they have small heads, firm compact plumage, and long pointed wings — adaptations that allow them to fly at great speed. In flight they use quick, powerful wing strokes. Their strong, hooked beak and powerful talons mark the falcons as highly specialized predators.

The peregrine is a sturdy crow-sized falcon. As in all falcons, the female (called the “falcon” by falconers) is larger than the male (called the “tiercel”). Adult males are 38–46 cm long and weigh about 570 g, whereas females are 46–54 cm and weigh about 910 g. The most reliable distinguishing features of the peregrine are the blackish malar stripe, or “moustache,” below the eye and the dark bluish-grey or slate-coloured crown, back, and upper surface of the wings. The throat is white and the under parts are white to buff, with blackish brown bars on the sides, thighs, abdomen, underwings, and lower breast area.

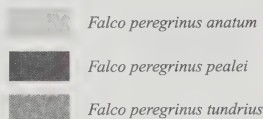
Distribution and migration

The peregrine has an almost worldwide distribution excluding Antarctica, New Zealand, and Iceland. Twenty-two races are recognized throughout the world. Their great powers of flight have enabled them to establish nesting populations in the Arctic, and as far south as Tasmania, South Africa, and the Falkland Islands.

As the map shows, three subspecies of peregrine nest in North America: Peale's *Falco peregrinus pealei*, anatum *Falco peregrinus anatum*, and tundra *Falco peregrinus tundrius*. Peale's peregrines are large dark birds that nest on the coast of Alaska and British Columbia, mostly resident or only slightly migratory. The anatoms are medium-sized peregrines

Distribution of the Peregrine Falcon in Canada

Breeding range



richly pigmented with buffy salmon on the breast; they often have black cheeks. They nest south of the tree line throughout the remainder of continental North America and are migratory in northern areas and resident farther south. The tundras are smaller, paler on the breast, and highly migratory arctic peregrines. Peregrines banded in the Northwest Territories have been recovered in Argentina; most arctic nesters apparently leapfrog their more southern North American relatives to winter in South America.

Hunting habits and prey species

Some birds of prey soar or hover in the sky and others have evolved short wings for quick, darting flights in forested country. The peregrine's speed and size make it an excellent hunter, able to take some of the larger birds. The long-winged raptor specializes in direct pursuit in the open and thus favours non-forested areas in which to hunt, particularly shores, marshes, river valleys, open moors, and tundra. Even though its level speed of flight exceeds that of most birds, the peregrine takes advantage of height from which to launch its attack. The top speed of its dives (stoops) at prey is estimated at well over 300 km/h.

A stooping peregrine is a hurtling wedge of streamlined feathers, its feet lying back against the tail and wings half-closed. At such speeds it delivers a fierce blow to the prey with a half-closed foot, the usual method of disabling or killing medium-sized and large prey. If the quarry is too

heavy to carry, it is allowed to fall to the ground, and the bird lands beside it to feed. It catches lighter prey in midair or else strikes it down and then retrieves it. Small prey such as swallows or sandpipers are snatched in mid-flight with the talons.

Falcons have a system of baffles in the nostrils to enable them to breathe during dives. Ancient falconers attempted, probably without much success, to judge a bird's speed by the number of baffles. Falcons also have extremely acute eyesight, even in dim light, and most hunting activity is around dawn and dusk. The peregrine's flights at intended prey are often unsuccessful. The ability of the falcon, agility of the prey, and availability of escape cover affect the success of each stoop. As is usual in predator-prey relationships, the aberrant or weaker prey individuals are singled out.

The prey species of such a cosmopolitan predator vary greatly from region to region and even from one nesting site to the next. In parts of the Queen Charlotte Islands, British Columbia, peregrines feed almost entirely on the Ancient Murrelet, a small seabird nesting there in countless thousands. On the east coast of Labrador, peregrines eat Black Guillemots, another common seabird, and small mammals (mice and voles). At Rankin Inlet, on the west shore of Hudson's Bay, peregrines eat mostly lemmings and shorebirds. In southern Canada, peregrines eat a variety of birds that live in wetlands, including Franklin's Gulls, Black Terns, Lesser Yellowlegs, Eared Grebes, Common Flickers, Green-winged Teal, and Sora. In cities, peregrines do eat some pigeons, but

these rarely account for more than 20% of their diet.

Life history

The peregrine nests mostly on precipitous cliffs. In remote relatively undisturbed areas such as the Canadian Arctic, steep slopes, river cutbanks, and even low rocks and mounds may be used. In North America, nests occur only rarely on flat ground or in trees, but such sites are commoner in other parts of the peregrine's range. In southern Finland, for example, there were large ground or bog-nesting populations, which now nest only in northern Finland but at lower densities. In Germany, large tree-nesting populations have apparently vanished.

Peregrines are territorial during the breeding season. Even in areas where nests are most numerous, nesting pairs are usually more than 1 km, and often much farther, apart. This ensures adequate food for all nesting pairs and their offspring. The immediate nest site is defended against other peregrines, and often against eagles or ravens. An extraordinary feature of peregrines is their traditional use of certain ledges for nesting. Successive pairs have nested on the island of Lundy, off the coast of southwest England, since at least 1243.

Females scrape a shallow hollow (usually in the loose soil, sand, gravel, or dead vegetation on cliff ledges) in which to lay their eggs. No nest materials are added. Most cliff nests are on ledges with vegetation and under an overhang. Sites with a southerly exposure are generally favoured. Within a breeding territory of several square kilometres a peregrine pair may have several alternate nesting ledges. The number used by a pair or its successors can vary from one or two to seven in a 16-year period.

A recent departure from the tradition of nesting on cliffs is the peregrine's use of tall buildings. The most famous of such birds was the "Sun Life falcon," a female that appeared as a yearling in 1937 outside the twentieth floor of the Montreal headquarters of the Sun Life building. An aggressive bird, she remained for 16 breeding seasons, had three successive mates, and reared 21 young. Her readily observable nest site gave rise to a host of admirers and considerable newspaper coverage. Her breeding record remains unmatched in the annals of bird study. Some more recent city nestings, a direct result of introductions of captive-raised falcons, occurred in Edmonton, Calgary,

Winnipeg, Quebec City, St. John's, Toronto, Red Deer, and Ottawa.

During spring courtship rituals the male courts his larger mate with aerobatics and loud repeated *wichew* calls. Soon after, the female lays three or four mottled brick-red or mahogany eggs, one every second day. Incubation, by both adults, begins when the last or second-to-last egg is laid, and continues for about 32 days. Re-nesting following loss of the first clutch is rare in the Arctic owing to the short summer season, but is regular farther south. As a result of some infertile eggs and natural losses of nestlings (eyases), the average number of young found in nests is 2.5 and the average number successfully gaining flight (i.e., fledging) is about 1.5.

Flight silhouette of a Peregrine Falcon



Peregrines become excited and some become aggressive when humans approach the nest, particularly if young are present. Aggressive birds may dive within a metre of intruders, screaming a high pitched *cack-cack-cack*. Because the calls often become more intense the nearer one gets to the nest, the peregrine may unknowingly aid rather than intimidate the nest seeker. Although similar, the voices of the two sexes can be distinguished; that of the male is more wheezy and high-pitched, that of the female is grating and coarser.

Newly hatched nestlings are awkward bundles of creamy white down with disproportionately large feet. At about three weeks, the first juvenile feathers start to appear, and feathering is complete in about three more weeks. The young spend 35–45 days in the nest, and males usually make their first flights a few days ahead of

females. Eyases are fed regularly by both parents, who pluck the feathers from the prey at a nearby plucking perch before taking the food to the nest. When the nestlings begin to fly, the parents fly by with prey in their talons and the young attempt to snatch it from them in midair as they pass. After several weeks of such instruction, the young begin to catch their own prey.

The juvenile plumage is worn for a year with only slight changes due to wear and fading. Adults moult and replace the wing feathers, one at a time, during the summer. Sexual maturity is reached at about two years of age. Individuals have lived 18 or 20 years, but the average lifespan is probably much shorter.

Conservation

Peregrine Falcon populations were long noted for their stability. In Great Britain, for example, where a host of birdwatchers and falconers studied them, the breeding population of some 600 pairs changed little from Elizabethan days until the 1940s. During the war, peregrines were eliminated in some areas to protect homing pigeons. Although these populations recovered after the war, from about 1945 onward many once-vigorous peregrine populations suffered widespread, unprecedented declines, particularly in Europe and North America. In the eastern United States, where at least 300 nests were once known, peregrines were nearly extinct by the 1960s.

A decline of such rapidity, magnitude, and distribution at first puzzled ornithologists. Direct human intervention, such as nest robbing, trapping, or shooting, was ruled out as the primary cause, as falcons were subjected to these onslaughts for hundreds of years. Research studies strongly suggested that persistent chemical pesticides or industrial pollutants were the major cause of the decline. Not only did the peregrine decline correspond closely in its timing and geographical extent with intensive post-war use of pesticides, but high pesticide residue levels were found in the falcons and their eggs. In 1969 in Canada and in 1972 in the United States, restrictions were placed on the use of DDT, a persistent pesticide that contributed to the peregrine's decline. Nevertheless, Canadian falcons probably acquired contaminants on their wintering grounds in Central and South America. Also, contamination reaches all North American falcons in prey that has migrated from those regions.

Although they have few enemies and a long lifespan, peregrines, like other predators, are at the top of a food chain. Because they eat birds that may have eaten grain or insects containing pesticides, they are exposed to much higher levels of pesticide residues than are found in the air or water, and they accumulate pesticide residue levels many times higher than the levels in their prey species. At high levels these chemicals may cause reproductive failure by interfering with breeding behaviour, eggshell formation, and hatching success. Thus peregrine populations may gradually dwindle due to the lack of breeding success. Serious declines in numbers of Osprey and Bald Eagle were also attributed to side effects of pesticide residues.

Peregrine Falcons, like virtually all birds of prey, now receive legal protection in most parts of North America. In other parts of the world, however, protection is much less complete, and populations are endangered by adults being shot and young being taken from nests.

In Canada the anatum peregrine is currently designated as "threatened" by the Committee on the Status of Endangered Wildlife in Canada, and the Peale's and tundra peregrines are considered species of "special concern". Previously the anatum had been classified as "endangered" and the tundra as "threatened," but recovery efforts have improved their status. Captive breeding and release has been the chief recovery method.

Over 1650 peregrines were bred in captivity at the Canadian Wildlife Service breeding facility at Wainwright, Alberta, and at university-based facilities in Saskatchewan and Quebec and a private facility in Alberta. Wildlife agency and non-government staff released the captive-raised falcons from natural cliffs and tall buildings at over 60 sites from southern Alberta to the Bay of Fundy. During 2000, more than 110 pairs of peregrines bred in southern Canada, over 300 pairs in Yukon and the Mackenzie valley, and several thousand pairs across the Arctic. A similar reintroduction program in the United States has resulted in over 200 pairs in the eastern and midwestern states. Over 7000 pairs of peregrines are now thought to breed in North America, including Mexico.

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Canadian Wildlife Service

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Également disponible en français sous le titre
Le faucon pèlerin.

Published by authority of the Minister of the Environment
©Minister of Public Works and Government Services Canada, 1985, 1988, 1990, 1996, 2001
Catalogue number CW69-4/32-2001E
ISBN 0-662-30087-4
Text: Don Blood
Photo: R. Fyfe
Revised by Ursula Banasch, 2001

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Hinterland Who's Who

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Ruffed Grouse



Put-put-put-put-purrrrr! Have you heard this sound in the woods in spring? Throbbing like a far-off motor boat, it is the mating call of a male Ruffed Grouse or "drummer". Quietly stalk him and he will likely be found on a large moss-covered log at the edge of a forest opening. If you beat your fist on the ground you may stimulate him to drum.

The Indians called the Ruffed Grouse "the carpenter bird", because they thought it drummed by beating its wings against a log. The sound is really made by the bird cupping and rapidly beating its wings against the air. As far as we know, the drumming warns other male grouse to keep away and attracts hens when they are ready for mating.

The Ruffed Grouse is common throughout most of Canada and much of North America. It does not migrate and, once established, lives all its life within a few acres. Its large size, rich colours, and the explosive burst with which it takes flight are distinctive. As a conspicuous member of our forests and a most popular game bird, it adds very much to the delights of the outdoors.

The Ruffed Grouse is frequently called "the partridge". This leads to some confusion because of the European, or Hungarian, Partridge that has been introduced to Canada. The Ruffed Grouse is only distantly related to the Hungarian Partridge, which is more like a chicken.

Appearance

The scientific name for the Ruffed Grouse is *Bonasa umbellus* L. Both terms are from the Latin: *Bonasa* means good when roasted (indeed!) and *umbellus*, a sunshade. This refers to the ruff of dark-coloured neck feathers that are particularly large in the male. When he is in display before the female, these are erected and surround his head almost like an umbrella. By nodding his head and ruffs, spreading his tail and strutting, the male identifies himself to the female and encourages her advances. The letter "L." after the



name signifies Linnaeus, a famous Swedish biologist who founded the present system of naming plants and animals, and who first described accurately and named the Ruffed Grouse.

The Ruffed Grouse is about the size of a bantam chicken and weighs one to one and a half pounds. Unlike the chicken, it has a broad flat tail which is usually held down, but may be erected and spread into a half circle.

The dappled and barred plumage ranges in colour from pale grey through sombre red to rich mahogany. In the east most grouse are predominantly grey, while others are red. Greys are in the majority in the central parts of the continent, while on the West Coast most grouse are reddish.

The colours worn by the grouse are related to the kind of habitat in which they are found: the dark colours in dark forest, as on the coast; the greys, in lighter bush. This camouflage helps protect the grouse from their enemies.

Males are hard to tell from females at a distance, but males are larger with larger ruffs and a longer tail; and in the male the broad band of dark colour in the tail is usually unbroken. In the spring, the behaviour of each sex may be quite different.

Origin and distribution

Because all records, including fossil remains, are confined to this continent, Ruffed Grouse are thought to have originated in North America millions of years ago. A pheasant-like ancestor probably migrated from Asia across land that bridged the Bering Sea.

Once here, the ancestral stock evolved into several lines of chicken-like birds; and one line we recognize today as grouse — the family *Tetraonidae*. Within the family, there are several different kinds of grouse that have adapted to life in various habitats. The Ruffed, Spruce, and Blue grouse live in forest; the Prairie Chicken, Sharp-tailed and Sage Grouse are found on the prairie, prairie edge, and desert; and the White-tailed, Rock, and Willow ptarmigan are found in arctic and mountain tundra.

Some early forms even returned via the land bridge to Asia and Europe, where their descendants can be identified today as the Capercaillie, Black Grouse, and Hazel Hen. While different in many ways and widely separated geographically, the grouse of the world show their common evolutionary origin by sharing fundamental features of their biology. For example, all male grouse seem to flutter their wings loudly during sexual display.

The differences among grouse can be explained by the way each has become a specialist in its particular habitat. Thus, the Ruffed Grouse is adapted to a life in hardwood bush and forest — its beak, legs and wings, and gut are adapted to permit it to feed as a browser on buds, leaves, and twigs. The bird is an excellent climber among

slender branches and on thin, yielding stems; and this possibly explains why, among the grouse, it is relatively small, with long neck, limbs, and toes. This grouse is expert at short, rapid, twisting flights, and can actually hover and make complete turns in the air — all handy traits for flying through thick bush. However, it is essentially a ground-dwelling bird.

The Ruffed Grouse is found wherever there are even small amounts of broad-leaved trees, especially aspen, birch, and willow, that provide the buds which are its staple winter food. And since deciduous forest occurs right across Canada from east to west, from Alaska to deep into the United States below and east of the Great Lakes, the Ruffed Grouse is widely distributed indeed.

The deciduous trees, important as food and shelter to the Ruffed Grouse, frequently occur in the early stages of forest regeneration after logging and fire. It is likely that we have more Ruffed Grouse now than before the white man came, because much of our coniferous forest has been cut or burned, and succeeded by aspen and other trees favoured by grouse. As these young forests grow and change from a mixture of coniferous and deciduous trees to mostly conifer, Ruffed Grouse populations will decline and in some places disappear. A return of large areas of old conifer forest to youth by cutting and burning, or natural catastrophe, brings back the grouse.

Life history

The life of a Ruffed Grouse takes its measure from the seasons; and through the year individuals make the best of what is possible. Spring is mating time. The male drums or advertises himself from a number of drum posts, usually old logs. He establishes himself among other male grouse by drumming and fighting, and stays on his territory throughout his life. Other males are chased away, and females are courted on the areas occupied by established males. Near their display posts, males find all the other requisites for life, such as roosts, shelter from weather and predators, food, and places to dust-bathe.

The hens in spring must find the food to make good eggs that will produce healthy young. Like the males, hens live alone and are spread through the forest; but, unlike them, they do not display themselves, and they move over a larger area. Wildlife biologists who have attached small radio transmitters to the backs of hens have found that hens cross trails with each other and may travel through the territories of several males and mate with several others. When they are ready to mate, hens are attracted by a drummer and will mate with him. Both males and females mate with whatever grouse presents itself at this time.

After mating, the hen selects a nest site which may be some distance from her mate and even on the territory of another male. Her nest is

always on the ground and usually at the base of a tree, stump, or rock, close to an opening and in forest that provides shelter.

The nest is simply a shallow bowl in the ground, lined with whatever is at hand and feathers from the hen. She lays from 7 to 14 eggs, and incubates them from 22 to 24 days. Most nests hatch in early June. Only one clutch is produced a year, although some hens will lay again if their first set of eggs is destroyed early in incubation. Most of the hatch in an area comes within a very few days. This timing possibly reflects the way the production of eggs is geared to the growth of new vegetation in spring.

A nest of eggs, once discovered, is easy prey for a number of birds and mammals that take the eggs for play or food. The hen will sit still on her nest almost until you touch her. She usually leaves the nest to feed in the early morning and late evening, when the uncovered eggs are hard to see. This behaviour and her camouflage of plumage are most effective, and relatively little mortality to grouse occurs through the destruction of nests.

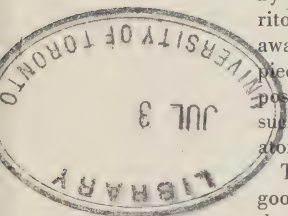
The hen leaves the nest with her young within a day after they have hatched. The brood may then set out and travel a long distance before settling down to live upon a relatively small brood range. It appears that the hen seeks out an area that is best for the survival and growth of the young. The brood lives as an independent group, although they may pass males and other broods as they travel about.

The hen and chicks behave in many ways that protect the young, particularly before they can fly. For example, when startled by intruders the hen directs attention away from her chicks by hissing, clucking, and dragging one wing as if it were broken. She appears quite helpless and a ready meal. Try to catch her and she bursts into the air and away. Meanwhile the chicks have burrowed deeply into the litter of the forest and vanished.

Throughout the summer the chicks grow rapidly in size, weight, and plumage. They feed heavily on insects at first but always take succulent vegetation; and by August they enjoy a diet of a variety of flowers, soft leaves, berries, and some seeds. Clover is particularly attractive to broods of grouse, and they frequently find this plant along old roads through the forest. It is here that many young grouse are taken by hawks and hunters.

Starting in June, the old birds gradually moult and replace all their feathers. It is not unusual to see a grouse in late June without a tail at all! The chicks replace their natal down with a rough, poor-quality juvenile coat, then replace this with the yearling plumage by 16–17 weeks of age. This plumage is generally similar to that of the adults.

The early mortality of grouse chicks may be very high. Within a week or two after hatching,



half the hens may lose all their young and the remainder may have broods about half the size of the clutch. Recent studies suggest that the early mortality may be largely due to the kind of eggs produced by the hen. This, in turn, is influenced by her diet in winter and early spring, when she stored within herself the food reserves of her unhatched chicks.

Other mortality to young grouse is caused by accidents, predation by the fox, Goshawk, and Great Horned Owl, and diseases such as a damaging stomach worm, *Dispharynx*, which gets into grouse by way of wood lice they take as animal food. Young and old grouse may carry a number of other worms in their intestines and malaria-like parasites in their blood. These are usually harmless to the grouse. Very rarely are any diseases of grouse harmful to humans.

In autumn, when the young are almost fully grown, there is another period of relatively intense activity in the life of grouse. Males begin to drum again, and broods frequently break up as young grouse disperse throughout the forest, seeking a place of their own to live. If new grouse are driven away by established birds, they may never find a home and may die. Others may establish themselves on the territories of old birds which die.

The established birds are secure because they have obtained a place that will provide food, and shelter from weather and predation. The displaced grouse, usually young, are forced into habitat where food and cover are inadequate and are therefore "doomed to die". These grouse are an expendable surplus and may be harvested by hunters without harm to breeding stocks.

The winter may be a hard time for grouse, especially for those that do not become established on an area in fall. In winter, broad-leaved foliage is much reduced or eliminated, exposing grouse to predators as well as forcing them onto their staple winter diet of buds and twigs.

The Ruffed Grouse is equipped to handle winter weather, but extreme cold and wind with little snow may cause heavy mortality. Where the snow is deep, soft, and persistent, grouse travel over it with the help of their "snowshoes" — lateral extensions of the scales of the toes. They also burrow into the snow, which keeps them warm and protects them from predators.

A good winter is one with soft, deep snow that lasts. Should there be little snow or hard crust and long periods of cold and wind, grouse cannot find adequate protection. They are forced to seek shelter in clumps of thick conifer. Under these conditions grouse lose weight and suffer heavy mortality to predation. A shortage of food and bad weather may cause some grouse to die.

Observing grouse

Try grouse watching and then try to explain some of the things you observe. It is a fascinating

pursuit. If you search carefully through the forest you are bound to find many evidences of Ruffed Grouse if they are there at all. From these observations you can build up some idea of the activities of grouse.

Grouse droppings look like those of chicken. Drum logs are easily identified by the piles of droppings on them. Droppings and feathers show where grouse have been, roosted, or paused in hiding. Where there is sand and rotting wood, grouse will make depressions and tracks which show their dust bathing and passage. In winter, tracks and roosts in the snow and bits knocked from trees are added to the usual clues which show the presence and activity of grouse.

Management

Grouse populations are sparse in some regions and dense in others. They also may fluctuate between abundance and scarcity in the same area. These fluctuations still need better explanations. Dense and relatively stable grouse populations seem to occur most frequently in forests on rich soils. This may be explained by the better quality of food and shelter available for grouse in these forests.

The control of predators and disease does not offer much hope of increasing numbers of grouse. Hunting by humans has little effect on numbers. Most hunting is directed against young birds along the edges of roads and in openings and many of these will die anyway. Other, older and established grouse are deeper within the forest, where few hunters go.

Co-operation between forestry and wildlife managers is more likely to ensure that this attractive bird will remain abundant. By selective cutting and burning we can harvest the forest and create habitat productive of grouse.

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Environment Canada
Wildlife Service

Environnement Canada
Service de la Faune

Issued under the authority of the
Honourable Jack Davis, P.C., M.P.
Minister of the Environment
© Information Canada, Ottawa, 1973
Catalogue No. CW 69-4/15
Text: J. F. Bendell
Photo: Paul Pohlman
Design: Gottschalk + Ash Ltd.

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Shorebirds



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Shorebirds form one of the most interesting, important, and spectacular groups of birds in Canada. They include species with some of the longest migrations known: some species breeding in the central Arctic travel to wintering grounds near the southern tip of South America, while others breeding in the extremes of the eastern and western Arctic move to Europe and Asia/Australasia, respectively. Shorebirds comprise a diverse group of species, including the plovers, oystercatchers, avocets, stilts, turnstones, sandpipers, yellowlegs, snipes, godwits, curlews, and phalaropes. They spend much of their time in wetland habitats and derive their name from the fact that they are often found along the shores of oceans, lakes, and other wet or marshy areas.

To the uninitiated, many species of shorebirds, especially the smaller sandpipers, appear confusingly similar, representing variations on a design involving long legs, a long bill, sharp, dynamic wings, and a streamlined body. These design features all reflect the lifestyle for which the birds are adapted — long legs for wading in water or on mudflats or marshes, the long bill for searching for invertebrate prey by probing into Arctic tundra or a variety of substrates, and long wings and a streamlined body for swift flight over long distances.

Although they spread out during the breeding season, many shorebirds gather in large flocks during migration and on the wintering grounds. This is the time most people may be familiar with them in Canada. Huge concentrations, involving tens or sometimes hundreds of thousands of birds, can occur on migration in places such as the Bay of Fundy in eastern Canada, on Prairie lakes, or on the Fraser River Delta on the west coast. Few people will not feel a sense of beauty and mystery as they watch a huge flock of sandpipers wheeling over the mudflats of a large estuary, ripples of light and dark passing through the flock as the birds' wings catch the sun. In addition to providing aesthetic pleasures, shorebirds are of great interest scientifically — how do they cope with such an energy-demanding lifestyle, how do they find their way between destinations continents apart, and how are they adapted to cope with environments ranging from Arctic tundra to tropical mudflats?

Breeding behaviour

In North America, most species of shorebirds breed in the Arctic or sub-Arctic, especially the sandpipers and allied

species. A smaller number of species breed in the boreal and temperate areas of North America, perhaps in grasslands or marshes or along beaches and shorelines of lakes or oceans. A few more breed southward through the tropical zone.

In the Arctic, shorebirds inhabit the vast expanses of open tundra north of the treeline. The summer breeding season is short, often with not more than six to eight weeks available for nesting. There is thus a premium on early arrival. Many species arrive while the ground is still covered with snow and food is scarce. In the far north, some species in effect bring food with them in the form of extra body reserves of fat and protein laid down at migration sites on the way north. These reserves can be important in surviving the cold Arctic spring and ensuring that the birds are in good health to start breeding. As the spring thaw proceeds, nesting commences, with the male setting up a territory over which flight and song displays are made, and from which rivals are chased. Pairing takes place, if it has not already done so, and the male makes a series of nest scrapes in suitable habitat, one of which is selected by the female in which to lay the eggs. Species vary in their choice of habitats: some prefer marshy areas, with nests hidden in the vegetation, whereas others nest on drier, more open habitats, with the nest perhaps in a low spreading patch of vegetation. The breeding plumage on the back of these nesting birds provides effective camouflage from predators.

Females usually lay four eggs over a five-day period, the weight of the clutch in some cases approaching the weight of the female herself. Incubation usually starts when the clutch has been completed, sometimes after the third egg. In many species, this task is shared by both male and female about equally. Despite being located on the ground, nests are often hard to find, even for predators, which include mammals, such as the Arctic fox, and other birds, such as jaegers and gulls. The birds deal with predators in a variety of ways. Some sit motionless, melting into the tundra until the danger passes. Others utter loud alarm calls and attack vigorously with an aerial chase or by dive-bombing; often birds from adjacent territories join forces in expelling an intruder. Ground predators may be led away from the nest by a distraction display in which the bird feigns injury, flopping along the ground as though it had a broken wing. The distraction display can also be a “rodent run,” in which the bird runs along in a hunched-up posture with its back feathers up and tail depressed looking just

like a rat or lemming and emitting a high-pitched squeal.

The eggs hatch after about three weeks. The new chicks already have a downy covering of feathers and well-developed legs and bills. Within 24 hours the family has left the vicinity of the nest. Although the young are able to run around and feed themselves from the start, they must return to the adult for the first few days to be kept warm by brooding, until they are capable of maintaining their own body temperatures. Both adults attend the young for the first few days, leading them to suitable habitats and keeping watch for predators. Territorial boundaries dissolve, and often the family party may wander several kilometres from the location of the nest. In many cases, the female departs before the young have grown the feathers needed for flying, or fledged, leaving the male to stay with the chicks until they can fly. There is probably greater long-term survival value for the female in making an early departure on migration than in staying to help guard the young — and thus a better chance of her returning to lay more eggs the next year. After some three weeks, the young fledge. Soon after, the male departs. The young follow after most of the adults have already left.

The majority of sandpiper species adopt the breeding strategies outlined above. There is, however, a wide variety of breeding behaviour across the shorebird group. In some species, only the female incubates the eggs. In others, a female may lay more than one clutch of eggs, either for successive different male partners or perhaps one for a partner and one for herself. In still others, males gather at communal display grounds called “leks,” which are visited by females for mating, leading to an essentially promiscuous breeding system. And in the phalaropes, the female departs after laying the eggs, leaving the male to do all the work of incubating the eggs and looking after the young.

“Fall” migration

With the departure from the breeding grounds in autumn comes a distinct change in the lifestyles of most shorebirds. On the tundra, many feed on surface insects and are dispersed widely over breeding territories, occurring in small numbers in family parties or small flocks. On migration, they feed on intertidal species lacking a back bone, known as “invertebrates,” on coastal flats at low tide and gather into enormous flocks at favoured roosting sites at high tide. The birds consume a variety of inver-

brates: examples include polychaete worms, bivalves such as *Macoma balthica* in James Bay, and the abundant mud shrimp *Corophium volutator* in the Bay of Fundy. Some species take interior routes through the continent, gathering to feed and refuel at wetlands and lakeshores.

Areas that provide the habitats and resources needed by the birds are often separated by long distances and involve flights over “ecological barriers,” such as oceans, deserts or forests, where landing and feeding would not be possible. In order to make these long flights, the birds have to be able to put on enough fat to provide the energy to fuel the many hours of continuous flying needed to reach their next destination. Birds leaving the east coast of North America, for instance, may fly for some 40–60 hours on a direct flight across the ocean to the north coast of South America. They fly at impressive heights, up to 3000 m or more. Overall distances can be enormous — species such as the Red Knot *Calidris canutus* and Hudsonian Godwit *Limosa haemastica* travel from the central Canadian Arctic to wintering grounds in Tierra del Fuego, near the southern tip of South America. With the reversal of the seasons between the hemispheres, these long distance migrants spend the summer season at both ends of their migration routes.

Winter habitats and destinations

Winter destinations of shorebirds do, in fact, differ considerably for the various species, and involve a wide range of habitats and climatic zones. The vast intertidal bays used by Red Knots and Hudsonian Godwits in Tierra del Fuego are almost as far south of the equator as their breeding grounds are to the north. Upland species, such as the American Golden-Plover *Pluvialis dominica*, are found on the grasslands and lagoons of Argentina and Uruguay. Sanderlings *Calidris alba* are most numerous on the long ocean beaches of the Pacific coast, especially in Peru and Chile. Ruddy Turnstones *Arenaria interpres* and Semipalmated Sandpipers *Calidris pusilla* occur principally on tropical mangrove-lined estuaries and coastlines on the north coast of South America, in Brazil, and the Guianas. Species using the Pacific “flyway,” such as the small Western Sandpiper *Calidris mauri*, are found on the extensive intertidal flats occurring in the Gulf of Panama, the Pacific northwest coast of Mexico, and San Francisco Bay. The Purple Sandpiper *Calidris maritima*, a specialist at using rocky coastlines,

occupies the most northerly wintering range of shorebirds on the east coast of North America, persisting about as far north as ice will permit in the Atlantic Provinces of eastern Canada and the New England states of the USA. The milder climate of the west coast of the continent enables species such as the American Oystercatcher *Haematopus palliatus* to live year-round on the coast of British Columbia.

Moult

After reaching their southern quarters, many shorebirds moult their body and flight feathers, replacing each with a new set. Feather wear is considerable during the course of the year; without the annual moult, the flight feathers would soon become so worn that the bird would be unable to fly. The flight feathers are moulted a few at a time, so that the bird is able to maintain the power of flight; this is in contrast to geese and ducks, which moult all their flight feathers at once and are then unable to fly until the new ones have grown. Shorebirds moult their body feathers at least twice in the year: once in the spring before the northward migration, when they attain a generally rather colourful breeding plumage, often with reds, browns, and blacks in striking patterns; and again in the autumn, when a much plainer “winter” plumage is gained, usually consisting of combinations of grey and white. As with many aspects of shorebird biology, there is considerable variation in the above pattern, with some species moulting before departure from the breeding grounds, and others moulting during pauses in migration.



The long legs, long bill, long wings, and streamlined body of the Greater Yellowlegs illustrate the anatomy of a typical shorebird.

“Spring” migration

In “spring,” most birds head north again; however, for the medium-sized and larger species, which may not start breeding until they are two or three years old, “summering” populations, consisting mostly of subadults, may remain in the south or migrate only partway to the breeding grounds. For many species, the route northward is different from that which the birds followed southwards. Food resources and climate result in different sites being attractive at the two seasons, and elliptical migration patterns are the result. As during the fall migration, spectacular concentrations of birds may gather at favoured sites. One example involves the enormous concentrations of Red Knots, Ruddy Turnstones, Semipalmated Sandpipers, and Sanderlings that gather in Delaware Bay during May to feed on the eggs of the Horseshoe Crab, a phenomenon occurring only at that time of the year.

Survival

Banding studies have shown that in some species the same birds often return to the same areas from year to year, whether it is during northward or southward migration. Birds have been known to adopt the same nesting territory from one year to the next, and in some cases even mate with the same partner. They may perhaps even have the same neighbors. The birds’ travels are thus far from random, each individual becoming familiar with a series of areas providing the resources needed at different times of the year. Again, however, there is a variety of behaviour, some species opting to take advantage of good conditions wherever they may be found in a given year rather than returning to a familiar area where conditions may not always be the best.

In general, however, familiarity with the same sites that is gained over a lifetime enables the birds to use the resources they need efficiently, thus increasing their chances of survival. Once they have survived the first year or so, shorebirds may live for considerable periods. Longevity records show that the largest species can live for over 30 years; medium-sized species probably live for 10–20 years; and the small species may live for less than 10 years, perhaps only four or five years, on average.

Population sizes

Obtaining the information needed to estimate the sizes of shorebird populations presents many problems. On the breeding grounds in the north, the birds are spread out in low numbers over enormous distances. Many of the wintering areas are in remote parts of South America where aerial surveys may be needed to obtain counts. While on migration in North America, the birds may be more accessible, but the rapid changes in numbers that occur as they pass through a site can complicate determining how many are using the area in total. It is only recently that information has been pieced together from all parts of the birds' ranges to come up with estimates of populations of the approximately 50 species occurring in Canada and the USA. These estimates range from a few tens for the endangered, possibly extinct, Eskimo Curlew *Numenius borealis* to several million for the most numerous small species such as the Semipalmated Sandpiper. Most shorebird species have populations in the low hundreds of thousands. Small species have larger populations than large species — in fact, there is a direct negative relationship between the average weight of the species and its estimated population size!

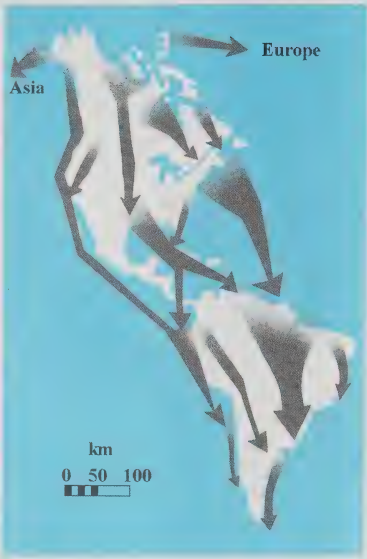
Population trends

Shorebird counts from various survey projects involving both amateur bird watchers and professional biologists over the past several decades have been very valuable in assessing the health of shorebird populations. The results of these studies, however, indicate that a majority of shorebird species appear to be declining in numbers. Most of the affected species appear to be long-distance migrants breeding in the Arctic. These results indicate an emerging conservation crisis for a major group of birds in Canada, and underline the need for research into identifying where the problems lie, and advancing appropriate conservation measures.

Conservation initiatives and issues

The growing awareness of threats to shorebird populations and their habitats has prompted the development of national shorebird conservation plans in both Canada and the USA. These plans should provide a powerful impetus for conservation action involving cooperation between all levels of government and non-government organizations. While shore-

Shorebird flyways
Southward migration



Shorebird flyways
Northward migration



birds may be singled out as a group requiring special attention (along with grassland birds and sea ducks), there is a need to integrate conservation initiatives for all birds, and shorebird conservation will be coordinated into a comprehensive approach to bird conservation known as the North American Bird Conservation Initiative (NABCI).

Because of their intercontinental migrations, however, successful conservation programs for shorebirds need to be international in scope. One such initiative that has emerged is the Western Hemisphere Shorebird Reserve Network (WHSRN). This program resulted directly from internationally coordinated research programs that showed that shorebirds use a restricted set of sites during their annual cycles and that these sites support a high percentage of their populations. These special places, which provide an exceptional abundance of food at the right time of the year, effectively form the links in a chain of sites that enables the birds to complete their migrations. For shorebirds to survive, all the links in the chain need to be preserved, since removal of one link would disrupt the entire migration system and prevent the birds from completing their annual travels. There are currently over 30 WHSRN reserves protecting shorebird habitat from Alaska to Tierra del Fuego.

The challenge of maintaining healthy populations of these intercontinental migrants is underlined by several aspects of their

biology and is certainly linked to human concerns and activities. Although many shorebird populations may appear numerous, their habit of concentrating in large numbers in one place at one time clearly makes them vulnerable to environmental accidents or degradation. The population declines that have been noted in recent years are not likely to be reversed quickly. Shorebirds are relatively long-lived and produce limited numbers of young each year, making them vulnerable to increased adult mortality. In addition, they face uncertain weather on their breeding grounds, which can adversely affect survival of young. Shorebirds are enormously dependent on the resources used at different stages of their annual cycles, and their migrations must be precisely timed to reach each area at the right moment.

Many of the areas frequented by shorebirds, including wetlands, estuaries, and coastlines, are prime targets for development, both industrial and recreational, and are often at risk from pollution. These habitats are among the most productive environments in the world, providing great natural and economic benefits to humankind as well as to wildlife. Many human activities depend on the healthy biological functioning of wetland ecosystems. Shorebirds depend on wetlands for their survival and are thus excellent indicators of the health of these important systems. In this sense, the study of shorebird populations and concern for their preservation are

more than simply a luxury or diversion, as they will provide valuable insights into the state of the environment. And the extensive migrations of the birds themselves remind us that the environmental concerns we are addressing need to be approached on an international level, and ultimately on a global level. The challenge of maintaining healthy shorebird populations is one that is related directly to our own future survival.

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The Canadian Wildlife Service

The Canadian Wildlife Service of Environment Canada handles wildlife matters that are the responsibility of the Canadian government. These include protection and management of migratory birds as well as nationally significant wildlife habitat. Other responsibilities are endangered species, control of international trade in endangered species, and research on wildlife issues of national importance. The service co-operates with the provinces, territories, Parks Canada Agency, and other federal agencies in wildlife research and management.

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Également disponible en français sous le titre
Les oiseaux de rivage.

Published by authority of the Minister of the Environment
© Minister of Public Works and Government Services
Canada, 1989, 2001
Catalogue number CW69-4/74-2001E
ISBN 0-662-29710-5
Text and photo: R.I.G. Morrison
Revised by R.I.G. Morrison, 2001

Striped Skunk



The striped skunk (*Mephitis mephitis*) is one of the most useful small mammals that inhabit the mixed farmlands, grasslands and forests of Canada. Unlike many other animals it has adapted well to the presence of man, and its present range, from central Mexico to the Northwest Territories and from Labrador to west-central British Columbia, is much expanded since primeval times.

The skunk prefers open areas of mixed forests and grasslands and has very little fear of man, so it has benefited from the new habitats created by the opening of the forests that accompanied settlement and agriculture.

There are four groups of skunks represented by eight species in North America, but only two species occur in Canada. The hog-nosed skunks (*Conepatus*) are confined to the southwestern United States, Mexico and South America, and the hooded skunk (*Mephitis macroura*) occurs in the southwestern United States and Mexico. Of the four species of spotted skunk (*Spilogale*), the eastern spotted skunk (*Spilogale putorius*) almost reaches the Canadian border between Minnesota and Manitoba, but only the western spotted skunk (*Spilogale gracilis*) actually occurs in Canada. There are a few records of this skunk in southern British Columbia, but only as far as 70 miles north of Vancouver. The striped skunk is the one familiar to most Canadians.

Characteristics

The striped skunk is about the size of a cat, but has a stout body, a rather small head, short legs and a bushy tail. Its small head fits conveniently, but sometimes too snugly, into enticing open jars.

The thick, glossy fur is black, with a thin white stripe down the centre of the face and a broad white stripe beginning on the back of the head, forking at the shoulders and continuing as a white stripe along each side of the back to the base of the tail. The tail is mostly black, but the stripes may extend down it, usually to a tuft of white at the tip.



Fur buyers grade skunk pelts into four groups depending on the amount of white in the fur. Black skunks are considered the most valuable.

The skunk has long, straight claws for digging out the burrows of mice, ripping apart old logs for grubs and larvae, and digging in the sand for turtle eggs. It moves slowly and deliberately, and depends for safety not on running away, nor on remaining inconspicuous, but on its scent glands.

Skunks belong to the weasel family Mustelidae, all of whose members have well-developed scent glands and a musky odour. The skunk is outstanding for this characteristic, however, and can discharge a bad smelling fluid to defend itself. Indeed its scientific name, *mephitis*, is a Latin word meaning "bad odour".

The scent of the skunk is produced by a thick, yellow, oily fluid, or musk, secreted by two glands located on either side of the anus at the base of the tail. The glands are about the size of a grape and contain about a tablespoon of musk, enough for five or six discharges. The glands are connected by ducts to two small nipples that are hidden when the tail is down and exposed when the tail is raised. The musk is produced rather slowly at a rate of about one-third of an ounce a week, and is discharged only as a last desperate measure after repeated warning signals.

A skunk is not an aggressive animal and will always try to retreat from a man or other large enemy. An angry skunk will growl or hiss, stamp its front feet rapidly, or even walk a short distance on its front feet with its tail high in the air.

The striped skunk cannot spray from this position. To perform that defence it usually humps its back and turns in a U-shaped position so that both the head and tail face the enemy. Many people used to the antics of the striped skunk have been deceived on their first encounter with a spotted skunk, which faces an attacker standing on its front feet with its back and tail arched forward.

The skunk directs the fluid from the glands into a stream that disperses into a fine spray. The spray can reach as far as 20 feet, and can be aimed with considerable accuracy for five to ten feet. The odour is strong enough to be carried at least one-half mile on the wind. At close range the spray of a skunk causes severe smarting of the eyes and even nausea, but these symptoms soon disappear as the nasal passages quickly become desensitized to the odour.

Various remedies are recommended to get rid of the odour on clothing or dogs that have been sprayed by a skunk, but some of the remedies are almost as bad as the musk. Vinegar or a mixture of vinegar and detergent is a simple and quite effective treatment. Veterinarians, who treat large numbers of dogs that have been sprayed by skunks, recommend a bath in tomato juice.

Skunks seem to be aware of the repulsiveness of their own odour, and avoid scenting on them-

selves. They therefore avoid musking in confined spaces, and their dens have little of the skunk odour about them. Skunks may be carried in a burlap bag or a covered live trap, as long as they are not bumped or badly frightened.

Habits

Skunks generally live in the abandoned dens of woodchucks, foxes, or other mammals their size or larger and only occasionally excavate their own dens. They will also use stumps, rock piles, or refuse heaps, or even will set up housekeeping under a house or porch or in a cellar. The latter practice is especially common in farming areas. Skunks that den under buildings should be trapped outside. Never shoot them under the building. To dispose of unwanted or locally harmful skunks without harming them, box traps may be used. Such traps permit easy handling of the skunks and transportation to more suitable localities for release. Once the skunk is captured, the trap may be covered with several burlap bags until it is transported several miles away and the skunk released. For information on obtaining such a trap, contact the local humane society.

If a skunk digs its own den, the den is usually simple, but one taken over from another animal may be quite elaborate. There may be from one to five well-hidden openings that lead to a system of tunnels and chambers. One of the chambers is lined with about a bushel of leaves and used for a nest. The leaves may also be used to plug the openings to the den in cold weather. A skunk gathers leaves by placing them under its body, and then shuffling along to the den with the leaves held between its legs as it moves.

Skunks may leave their den to forage at any hour of the day, but are usually abroad from late afternoon or evening through the night. They forage within about one-half mile of the den, but may venture as far away as a mile and one-half in a night. Males become more active during the breeding season, when they may travel four or five miles a night.

Skunks are truly omnivorous. They eat insects, mice, shrews, ground squirrels, young rabbits, birds' eggs and various plants. During the autumn and winter they eat about equal amounts of plant and animal foods, but eat mainly insects in the summer. Skunks are especially fond of grasshoppers, crickets and insect larvae such as white grubs, army worms and cutworms. They will even eat wasps and bees, which they kill with their front feet. Although they annoy farmers by raids on beehives and henhouses, it has been estimated that almost 70 per cent of a skunk's diet constitutes a benefit to man and only 5 per cent is harmful to his property.

By autumn skunks have acquired a heavy layer of fat and in November or December they select a deep den in which to spend the winter. As many as 20 skunks have been found in one den, but the

number is usually much fewer. Usually the mother and young den together, entering the den when the temperature reaches about 32°F.

Males are active until the temperature reaches about 15°F, and may join their own family, other males or may den alone. They may emerge briefly from their den at any time during winter. Any association of sex and age may be found together in a den.

By late February, in some parts of Canada, skunks begin to awaken from their winter state of torpor, and are fully active by the end of March. On the prairies and in the most northern parts of the range, spring emergence is somewhat later.

Breeding

Skunks begin to breed in late February or March, when they emerge from their dens, and the young are usually born in early May. There are usually four to six young in a litter, although the number may vary from two to sixteen.

A newborn skunk weighs about one-half ounce and, although almost naked at birth, shows the characteristic black and white colour pattern of the adult. They are fully haired in about 13 days and their eyes open after 17 to 21 days.

When the young skunks are approximately seven weeks old the female takes them out to forage for food, and they are weaned at about two months. They remain with their mother until autumn and may join her in the winter den.

Enemies

The scent of the skunk is an effective defence against most natural enemies. Nevertheless it is preyed upon by bobcats and birds of prey. Most birds, especially hawks and owls, have developed the sense of sight at the expense of their sense of smell; the Great Horned Owl in particular seems relatively unaffected by the scent and has made the skunk its principal prey.

Trappers take 6,000 to 7,000 skunks a year in Canada, but this represents only a small fraction of the total skunk population and has no appreciable effect on their numbers.

Motorists are a much greater hazard. Skunks, like porcupines, are overly confident of their defence mechanisms, and often pay heavily for the air of unconcern with which they cross highways.

Skunks as carriers of rabies

Skunks are a major carrier of the virus of rabies which all warm-blooded animals, including man, are susceptible to. The occurrence of rabies is a continuing problem in many parts of Canada. Skunks may transmit the disease to other wildlife, livestock, and to humans as well as propagating it among their own kind. While skunks will normally retreat from man, the rabid animal will often show no fear of him. Children in particular should be warned against handling "over-friendly" skunks.



If a person is bitten, he should cleanse the wound *at once* and report to a physician. Delay could result in a human fatality. The nearest federal veterinary authorities (Health of Animals Branch, Canada Department of Agriculture) should be alerted immediately. The skunk should be caught, if possible, for examination at one of the Department's Animal Pathology Laboratories.

Economic importance

Although skunks may become a nuisance to poultrymen and beekeepers, the damage they inflict is not economically important and they are beneficial to agriculture. In fact, skunks proved such an efficient enemy of the hop grub in New York State that legislation was passed to protect the skunk. In many parts of their range they are the most important predator on insect pests.

The skunk is a fur bearer of minor importance. Its fur, which is thick and lustrous, can be used for coats and jackets, but is mainly used for trimming. Most of the pelts marketed in Canada come from eastern Canada.

In the period following the First World War, when fur prices were high and unstriped black skunks were in great demand, various attempts were made to raise skunks on fur farms. Had fur prices remained at the level they reached during the boom, these ventures might have succeeded, but today the cost of raising a skunk is far more than the pelt is worth. The value of the skunk lies elsewhere. It is an interesting and attractive animal which plays a significant part in nature, specifically as a predator of mice and insects.

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Environnement Canada
Wildlife Service

Environnement Canada
Service de la Faune

Issued under the authority of the
Honourable Jack Davis, PC, MP
Minister of the Environment
© Information Canada, Ottawa, 1973
Catalogue No. CW 69-4/36
Text: R. S. Miller
Photo: Ed Cesar
Design: Gottschalk + Ash Ltd.

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Woodchuck





On the second of February each year, much of North America observes groundhog day. On that day, according to folklore, the woodchuck (*Marmota monax*) — sometimes called groundhog, or simply chuck — awakes from his long winter sleep and comes out of his den. If he sees his shadow he will go back in and we will have another six weeks of winter. If he does not see his shadow he will remain awake and active, and we will have an early spring. This popular old legend apparently came to North America with early settlers from Europe, where it is believed in some parts that bears or badgers behave in the same manner. While most people recognize that the legend has no basis in fact, it provides a welcome mid-winter diversion which is usually promoted by the news media. Actually most woodchucks do not come out of hibernation until March, or even later in the north.

Scientists recognize as many as nine varieties or subspecies of woodchuck, mainly based on subtle differences in colour or skull characteristics. They range widely in North America, particularly in the east where they are found from Alabama and Georgia in the United States to northern Quebec in the southern Hudson Bay region. In the west they extend northward to Alaska through the south of the Yukon and the Northwest Territories. Woodchuck distribution is spotty everywhere on the edges of the range.

A close relative of the woodchuck's, the hoary marmot or whistler, lives in the mountains of western North America, from Washington, Idaho and Montana northward into the Yukon and Alaska. It inhabits tundra, alpine meadows, and rock slides in high mountains. Two other marmots, probably of the same species as the hoary marmot, live only on high portions of Vancouver Island and the Olympic Peninsula. The rock-chuck, or yellow-bellied marmot, found from California, Texas and New Mexico to British Columbia and southwestern Alberta, is another close woodchuck relative. Where the woodchuck

is brownish this smaller cousin tends to be yellowish. It favours higher and rockier country than the woodchuck but is also found on agricultural land in foothills and valleys.

General appearance

Woodchucks are rodents and belong to the large family of mammals Rodentia, that includes squirrels, prairie dogs and chipmunks. Among North American rodents only beavers and porcupines are larger. Woodchucks are stocky little animals with a flattened head. They commonly weigh from 12 to 16 pounds and large ones may be heavier in the autumn. They measure 16 to 26 inches in total length, including a short bushy tail seldom over six inches long. Fur colour varies from place to place, and between individual animals. It ranges from yellowish to dark reddish brown, with an intermediate brown colour being the most common shade. The fur is usually grizzled in appearance because of light coloured tips on the hairs. The belly fur is commonly straw coloured and the feet black.

Woodchucks are occasionally found with melanistic or albino fur. The fur of melanistic specimens is completely black. Albinos, on the other hand, have no colour in their fur at all and even their eyes lack pigmentation merely showing a pinkish tinge from blood vessels near the surface. Being white, they are conspicuous, and usually fall easily to predators.

Because woodchucks are burrowing mammals their feet have sturdy claws and their legs are thick and strong. Their forefeet, the principal ones used for digging, each have four well developed claws and the hindfeet have five. They escape from enemies by diving into burrows, which may account for the fact that their top running speed does not exceed 10 miles per hour.

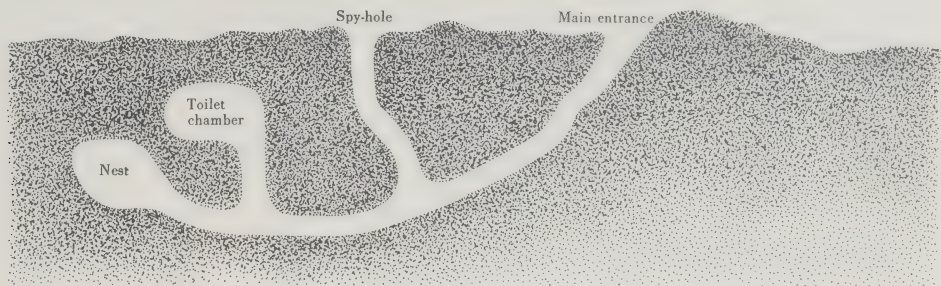
Breeding and young

Young woodchucks are born in March and April following a gestation period of 28 days. One litter, usually with four young, is produced per year. Woodchucks are blind and helpless at birth, about four inches in length and about an ounce in weight. At about 20 days old their eyes are open and they are covered with short hair. They are weaned when they start to emerge from the burrow at five to six weeks of age. Woodchucks grow rapidly. They weigh two pounds at eight weeks of age, and become very fat for hibernation. Woodchucks have been known to live for ten years, although the average life span is probably much less than that.

Food habits

Woodchucks prefer to eat fresh green vegetation. They eat a wide variety of wild plants, clover, alfalfa, and garden vegetables if they can get them. Occasionally they eat snails or insects.





Burrows

Woodchucks tend to avoid forests and damp or swampy areas. They prefer open areas such as fields, clearings, open forests and rocky slopes. They generally dig their burrows in areas where luxuriant grasses and other short-growing plants provide food. Summer burrows are often in the middle of pastures and meadows, and the animals will have a denning burrow, used only in the winter, in a nearby row or brier or bush thicket. Winter burrows, whether separate or part of a woodchuck family's main burrow system, are usually deep enough to be located below the frost level. Burrows usually have a main entrance, one or more "spyholes" for added safety from enemies, and separate toilet and nesting chambers. The same nest is used for sleeping, hibernation and as a nursery. It is made of dry grass in a chamber which may be a foot and a half wide and over a foot high.

Life history

When not hibernating or caring for young, woodchucks spend much of their time eating and sunning. They love to stretch out on warm ground, a smooth rock or along a low branch of a convenient tree. Their tree climbing ability is limited, however, and infrequently used. They seem constantly on the alert when outside their burrows and give a shrill warning whistle when alarmed. When fighting, seriously injured, or caught by an enemy, woodchucks give a squeal. Woodchucks also give low barks, but the function of this particular sound is unknown.

In preparation for their long winter sleep, or hibernation, woodchucks grow enormously fat towards the end of the summer. They begin hibernation with the onset of freezing weather, the adults before the young ones who probably need extra time to put on sufficient fat to see them through the winter. The first adults to hibernate disappear late in September and all woodchucks are underground in October.

Hibernation is a process of deep comatose sleep. Bodily functions are greatly retarded allowing the accumulated body fat to nourish the animal throughout the winter. Body temperature may drop to only 4 to 5 degrees above freezing

(37° F), and the heartbeat will drop from its normal rate of about 80 beats per minute to only 4 or 5. The breathing rate and consequent consumption of oxygen are also much reduced. When the animals emerge in the spring they generally still have a good deal of body fat left, which is necessary. Emerging in March, as many of them do, they find little food about them. They may even burrow up through snow to reach daylight. Several weeks may pass before the snow is all gone and there is abundant fresh green plant growth to eat.

Because they are Canada's largest true hibernators, woodchucks are the subject of a great deal of medical research. Scientists are studying their ability to lower their body temperature, reduce their heart rate and reduce their oxygen consumption. If it were possible to induce the same sort of reactions in man, even for brief periods, certain forms of heart surgery and other medical treatments would be much facilitated.

Values and uses

Woodchucks are the major hole-digging mammals over much of eastern North America, and in some places in the west. In the days when most farm vehicles and machinery were drawn by horses, woodchucks were viewed by man as decided pests. Burrow holes in meadows, fields and road edges all too often meant broken legs for horses that stepped into them. But now that horse-drawn farm machinery is no longer common, man is better able to admire the woodchuck as an interesting part of the environment and to appreciate the indirect benefits which his hole-digging provides.

All sorts of animals are able to thrive because of the shelter supplied by these holes. The list of animals using woodchuck holes for shelter is long; it includes a wide variety of fur and game animals, some of which destroy huge quantities of farm pests such as rats, mice and insects. Skunks, raccoons, foxes, rabbits and snakes all have a place on the list.

Many farmers still consider woodchucks to be nuisance animals because of the vegetation which they eat. Woodchucks do compete on a small scale with farmers' cattle for food, and occasion-



ally with the farmer himself if they can get into his garden. But the view that woodchucks are therefore pests is nearly always a short-sighted one which overlooks the benefits of having the animals about.

To many hunters, particularly in eastern North America, woodchucks are valuable game animals. Some hunters simply waste the carcass of the animal they shoot, but a growing number are learning that fried, roasted or stewed woodchuck can be just as tasty as any other small mammal. Late summer and early fall are the common woodchuck hunting seasons. Sometimes woodchucks are trapped for their fur, but it is generally of low value. Although not frequently tamed, the animals make affectionate pets.

Woodchucks are a natural prey for large carnivorous animals and in the past they were taken by bears, wolves, lynx and cougars. However, these major predators are scarce or absent over the predominantly agricultural landscape where most woodchucks live. The principal woodchuck predators today are eagles, foxes and coyotes. Woodchucks, curiously enough, can be fierce and determined fighters in defence of their lives and would probably be a match for any fox that was unable to take them wholly by surprise. There are many records of woodchucks having held dogs even the size of a collie at bay and driving them off.

Woodchucks have roles to play in the world we live in. Let us wish them a long survival.

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Environment Canada
Wildlife Service

Environnement Canada
Service de la Faune

Issued under the authority of the
Honourable Jack Davis, PC, MP
Minister of the Environment
© Information Canada, Ottawa, 1977
Catalogue No. CW 69-4/20
Text: J. P. Kelsall
Photo: Hans W. Hildebrandt
Design: Gottschalk + Ash Ltd.

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WHO'S WHO

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White-tailed deer. Photo by Dalton Muir

White-tailed deer

(Odocoileus virginianus)

Of all North America's big game animals, the white-tailed deer is the most widely distributed and the most numerous. Its range extends from the southern tip of the continent northward well into the boreal, or northern coniferous, forest. In southern Canada, the white-tailed deer can be found from Cape Breton Island westward to south-central British Columbia.

There are 30 recognized subspecies of the white-tailed deer in North America. In general, these subspecies grade in size from the large, robust specimens in the northern part of the range to smaller deer, such as the tiny Florida Key deer and the little Coues deer of New Mexico and Arizona, in the south. Full-grown male deer frequently exceed 38 inches at shoulder height and 250 pounds in weight, with exceptional individuals weighing up to 400 pounds in the northern part of their range. In comparison, the Key deer of Florida rarely exceeds a height of 21 inches at the shoulder

and is proportionately lighter in weight.

Only three subspecies of white-tailed deer are found in Canada. The northern white-tailed deer is found throughout eastern Canada, from about the Ontario-Manitoba border eastward to Cape Breton. The brushy draws, parklands, and forest fringes of the prairies, westward to the foothills of the Rockies, are inhabited by the Dakota white-tailed deer. The tawny northwestern white-tailed deer is found in southeastern British Columbia, occasionally straying down the eastern slopes of the continental divide into Alberta.

General description

Some parts of the western range of the white-tailed deer are shared by its somewhat stockier and heavier cousin, the mule deer (*Odocoileus hemionus*), but the two types of deer are readily distinguished by their appearance and habits. The characteristic "flag" of the white-tailed deer – upraised tail revealing a stark white underside and white buttocks, as it dashes away – is an unmistakable feature. Should it choose to escape detection, it is capable of "sneaking" inconspicuously through sparse cover with head and tail held low. The smooth-flowing gallop of the white-tailed deer contrasts sharply with the stiff-legged, bouncing gait which has earned the mule deer the descriptive term "jumping deer" or "jumper" in the Prairie Provinces. The ears of the white-tailed deer are relatively small compared to the conspicuously large, mule-like ears which have given the mule deer its name.

The antlers of the mature male white-tail consist of a forward-curving main beam from which single points project upward and often slightly inward. The mule deer, on the other hand, has branching antlers which divide and redivide into paired beams and points.

Life history

The spotted, wobbly legged fawns, weighing from four to seven pounds at birth, are born in late spring. While birth may take place from late March to early August, most fawns are born during the last week of May or the first week of June. Twin fawns are the rule, although single births are quite common. Triplets are not uncommon but quadruplets occur only rarely. Although the newborn fawn can get to its feet within minutes, and very



Range of white-tailed deer

soon takes its first nourishment from the doe's rich milk, it remains relatively feeble during the first two weeks of its life. It lies virtually in hiding, left unattended by the doe for hours at a time. The natural camouflage of its spotted coat and its almost scentless condition provide excellent natural protection. The doe returns at intervals to suckle the fawn.

It is during these first two or three weeks that people sometimes chance to find fawns in their lonely hiding places and, mistakenly believing they have been deserted by their mothers, carry them home to a life of captivity. In fact, a doe will rarely desert her fawn, and the little animals should not be touched.

As the fawn grows stronger it begins to follow the mother about during her feeding and soon learns to supplement its milk diet by nibbling on succulent vegetation. The doe, meantime, like other adult members of the deer herd, has been feeding voraciously on new spring vegetation. She has entered the spring period in lean condition and with a shabby, tattered winter coat. Gradually the coarse, grey winter coat is replaced by the fine, reddish summer coat. Improved food supply, consisting of leafy material from a

variety of woody plants, forbs, and grasses, and including such delicacies as fiddleheads, mushrooms, and blueberries, results in both doe and fawn becoming sleek and sturdy by midsummer.

In the early spring the antlers of the male begin to show as twin, dark protusions from the frontal bones of the head. Growth of the antlers and regaining of body weight continue rapidly through the late spring and early summer. Unlike true bone which has its internal supply of blood vessels and nerves, antlers are nourished by a tender external covering of "velvet" tissue which gives them a bulbous, distended appearance. The shortening days of late summer terminate growth of the antlers. The velvet dries and begins to slough off, revealing the hard, bony tissue of the antler. Shedding of the velvet is hastened by bucks rubbing their antlers against brush and small trees. The antlers are usually shed in January.

White-tailed deer are truly magnificent specimens in the early autumn. Their bodies are rounded out by reserves of fat stored for the lean months ahead. The new, thick, winter coat exaggerates the thickness and sturdiness of the body. Fawns have lost their spots and are now short-faced, smaller replicas of their parents. Late October and early November bring on the breeding season. Bucks with swollen necks travel almost incessantly, searching out the does and engaging in mock battles with their rivals. Sometimes a real battle develops, and occasionally the antlers of the combatants become hopelessly entangled, leaving both to die slowly.

The autumn brings another change which is of great significance to the life of the white-tailed deer. Summer's lush vegetation is now brown and dry. The leaves have fallen. Until next spring, when the new growth starts, they must depend for food on the twigs and buds which are within their reach.

Abundant food makes almost any forested or brushy area suitable for summer occupancy, but as snow deepens, the deer concentrate in areas which provide food and shelter from storms and deep snow. Sometimes the move from summer to winter range requires traveling many miles.

Even the most favourable winter concentration areas have a limited food supply. If there are too many deer using the area, the

most nutritious food disappears rapidly, leaving foods of only marginal value for the remainder of the winter. Deep snow worsens the problem. At snow depths greater than one and one-half feet, deer find it increasingly difficult to move about freely and tend to follow previously broken trails. The quantity and quality of food which can be reached from these trails further limit nutritional intake at the very time that intense cold and difficult travel are tending to increase the deer's energy requirements. Some of this energy requirement is met by conversion of the surplus fat stored during the late summer and early autumn. Once this remaining source of energy has been depleted to a low level, the deer's chances of survival until spring are very poor. It is not surprising that those which do survive a severe winter return to their summer ranges as little more than gaunt shadows of the proud, sturdy animals they were. The green growth of spring brings welcome relief.

Population controls

White-tailed deer are relative newcomers to much of the range they now occupy in Canada. When white men first explored the northern half of the continent they found deer in only the most southerly parts of Canada. Even in the year of Confederation their distribution was quite limited. There were no deer in Nova Scotia and they were not numerous in New Brunswick. Deer were in southern Quebec and extended some distance down the St. Lawrence River and up the Ottawa River. Although deer were numerous in southern Ontario, none had penetrated northward beyond Lake Nipissing. There were a few white-tailed deer in south central Manitoba, but most of the remainder of the Prairie Provinces was populated by only the mule deer.

It seems likely that man's activities – cutting and burning of eastern forests and curtailment of prairie fires, thus allowing brushy areas and bluffs to become established – helped the white-tailed deer to extend its range northward. (Bluffs are islands of forest vegetation which occur on the prairies and parklands.) Long-term easing of the severity of winters may have been equally important. Whatever the combination of causes, the range of the white-tailed deer extended con-

siderably during the late nineteenth and the first half of the twentieth centuries. Extension of range and development of substantial populations have been somewhat more recent in Saskatchewan and Alberta than elsewhere in Canada.

Thus, the white-tailed deer in most of Canada is living in marginal range which it has only recently managed to invade. It is not surprising, therefore, that severe winters cause marked declines in population levels through much of the presently occupied range.

Deer in Canada are relatively free of serious diseases or parasites. In much of their range their natural predators, such as the timber wolf, coyote, bobcat, and mountain lion, have been greatly reduced in numbers and rarely exert real pressure on the deer. Free-roaming dogs do sometimes take a heavy toll, particularly in late winter when crusted snow aids the dogs but hinders the weakened deer.

Deer reproduce quickly. A healthy herd is capable of almost doubling its numbers during one favourable year. Although a series of severe winters may tend to shrink the range of the white-tailed deer in Canada, a few favourable years permit it to reoccupy the lost ground, rebuild substantial populations, and even extend its range farther northward.

Management

Maintaining healthy stocks of white-tailed deer is primarily a matter of keeping numbers of deer in balance with their supply of winter food. Healthy deer populations grow very rapidly if the annual surplus of animals is not harvested. Overpopulation invariably leads to pressure on food supplies, which results in malnutrition – even in the face of heavy predation. Starving deer can do immense damage to their winter range, depleting suitable browse species and sometimes preventing regeneration of valuable forest trees. Moderately heavy hunting helps prevent these natural catastrophes by holding deer numbers in check while, at the same time, providing millions of man hours of healthy recreation and thousands of tons of valuable meat.

Man can do little to modify the severe winters which deal so harshly with the white-tailed deer, but he can help to provide and maintain the food and shelter which are so

essential to the deer's survival. Logging in the forest, which normally favours deer by opening the high canopy so that new growth will start on the forest floor, can be made even more beneficial to the deer if sufficient coniferous cover is allowed to remain to provide shelter from the deep snow. Hemlock is the best cover, followed by cedar, balsam, spruce, and pine. In areas where brushy or woodland cover is scarce, such as on the prairies, suitable deer habitat can be saved from fire or from land clearing. However, even the best habitat can be overwhelmed by the reproductive rate of the white-tailed deer. Only frequent, adequate harvest by hunting can maintain deer populations in a healthy, vigorous state.

Reading list

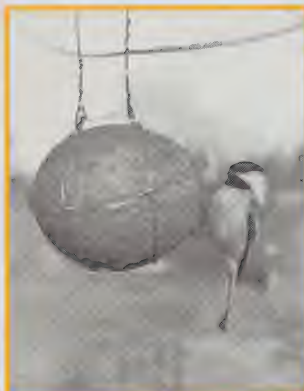
- The deer of North America. W. P. Taylor. The Stackpole Company, Harrisburg, Penn. 1956. 668 p.
- A history of Wisconsin deer. E. Swift. Wisconsin Conservation Department, Publication No. 323. 1946. 96 p.
- White-tailed deer in Saskatchewan. Saskatchewan Department of Natural Resources, Conservation Information Service. Conservation Bulletin No. 2. 1961. 17 p.
- The white-tail in Nova Scotia. D. G. Dodds. Nova Scotia Department of Lands and Forests. 1963. 30 p.
- The world of the white-tailed deer. L. L. Rue III. J. B. Lippincott Company, Philadelphia and New York. 1962. 134 p.

How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource of ever-increasing importance to the national welfare and economy.

For further information on wildlife in your province please contact your chief provincial game officer.

What you can do for wildlife



Environment
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Canada

Canadian Wildlife
Service

Service canadien
de la faune



A member of the Environmental Conservation family

Canada

We can all help

No matter what your age and no matter where you live, you can help wildlife. You will accomplish the most if you work together with other people — at a business or job, at school, at home with your family, or in your community with friends. Whatever your age, never underestimate the power of personal example. Both children and adults who show by their actions that they care about wildlife and habitat can have an important influence on other people.

This pamphlet lists some ideas for activities that help wildlife specifically. But remember, following any good advice about helping the environment — such as walking or using your bike instead of driving, turning off a computer when you are not using it, recycling, or turning down the heat and wearing a sweater — will reduce the physical demands that you make on the Earth and, together with other people's changes in behaviour, will make a difference for wildlife.

Wildlife needs habitat

Wildlife isn't just birds and mammals. The term also includes reptiles, amphibians, fish, insects, spiders, invertebrates, trees, shrubs, ferns, and other wild plants. It takes in, too, fungi of all shapes and sizes and bacteria and other microorganisms living in the soil, in water, and in the mud at the bottom of lakes, rivers, and oceans. It is important to protect not just plants and animals, but the whole ecosystem of which they are part and on which they rely for their survival. The part of the ecosystem where a wildlife species lives is known as its habitat. A habitat is not just a geographical place; it includes the food, shelter, and climate without which a species would not survive.

Loss of habitat is the biggest threat facing wildlife today. Every effort must be made to make all the areas where we live and work wildlife friendly and to preserve the

biodiversity of wilderness areas. We cannot leave this job only to government — the task is too big and diverse, and requires too much hands-on, active involvement. What wildlife needs is an army of Canadians who are committed to helping wildlife through their activities and the many choices they make in their daily lives.

Learning about wildlife

Learning about wildlife is an important first step in becoming involved. Getting outside and becoming an observer of life around you is a good way to begin. Try to incorporate nature hikes to a nearby park, wetland, or woodlot into your regular schedule.

You can also learn about wildlife from books, videotapes, and, in the case of birds, audio tapes. Every time you visit the library, bring home one book on wildlife, and encourage your family to read it. Taking up a quiet hobby that keeps you outdoors, like gardening, hiking, or beachcombing, increases your chances of seeing and learning about wild plants and animals.

Children can learn about wildlife at school through programs such as BIRDQUEST, Habitat 2000, and Project Wild. BIRDQUEST, offered by the Canadian Nature Federation and the Canadian Wildlife Service, is a program that teaches bird identification, ecology, and conservation and encourages participation in conservation activities. Through the Habitat 2000 program managed by the Canadian Wildlife Federation in cooperation with the Canadian Wildlife Service and Wildlife Habitat Canada, thousands of school children all across Canada have undertaken habitat restoration projects and learned about the requirements of wildlife in the process.

Becoming a member of a naturalist club is a particularly good way for children and adults alike to learn about wildlife and become involved in conservation. Natural-

ists visit wetlands on warm spring evenings to learn which frogs and toads make which calls. They conduct birding walks at dawn during the breeding season and take spring wildflower walks and fall mushroom forays. Naturalist clubs are also good places to meet other people interested in nature. Or if you prefer, you can learn about wildlife as a volunteer with a wild bird clinic, bird banding centre, or nature education centre that provides on-the-job training for volunteers.

Working for wildlife as an individual

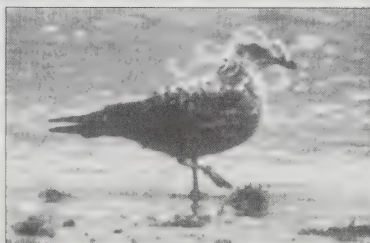
Daily living with wildlife in mind

Here are some ideas for helping wildlife in your daily life:

- Keep your domestic animals under control. Respect local leash laws. Dogs running free can harass and kill wildlife. A bell around the neck of an outdoor cat gives birds more of a chance. Domestic cats kill millions of songbirds a year.
- Use cars less. Cars pollute. As well, a lot of wild animals are killed trying to cross busy highways.
- Buy food grown without herbicides and pesticides. This supports farmers whose land is the most "wildlife friendly." Buy other "green" goods, such as ecocertified lumber and papers, for the same reason.
- Reuse or recycle your plastic products and avoid products with disposable plastic packaging. Animals have been known to die after swallowing plastic debris or becoming entangled in plastic six-pack holders.
- Watch what you put down the drain or into the regular garbage. Careless disposal can cause harm to wildlife, such as fish. Contact your municipal office to find out how you can dispose of anti-freeze, paint, varnish, used oil, and spent batteries.
- If you find a dead bird with a band on its leg or spot a live bird with a neck collar, wing tag, or other marker, send the band or report the marker to the Canadian Wildlife Service's Bird Banding Office (Tel.: 1.800.327.2263). Knowing where bands are found helps scientists identify the habitats used by birds.
- Buy the Wildlife Habitat Canada conservation stamps and prints. Proceeds go to habitat preservation.
- When you travel, be ecologically responsible. Avoid waste- and pollution-producing holidays. Support countries that are saving their forests and managing their coral reefs and beaches well.

1. Bluebirds have come back in North America thanks to hundreds of landowners who provided nestboxes for them. Photo: Robert McCaw.
2. A variety of homemade feeders can be used in backyards to feed birds. Photo: H.M. Halliday
3. Students at Rollo Bay, P.E.I., clean up a stream as part of a Habitat 2000 project. Photo: F. McNally
4. Learning about the wonder and variety of the natural world is the vital first step to involvement in helping wildlife. Photo: D. Muir
5. Each summer volunteers in the Breeding Bird Survey gather information that scientists use to determine population trends of songbirds and other bird species. Photo: J.S. Wendt

- When you travel, do not contribute to the profits of people who capture or kill endangered species. Learn about the regulations of the Convention on Trade in Endangered Species of Wild Fauna and Flora (CITES) and follow them when you travel. CITES makes it illegal to import goods made from endangered species, such as skins of leopards and ivory from elephants.
- If you are a hunter or angler, use non-lead shot and fishing gear so birds ingesting spent shot or lost sinkers will not be poisoned by lead. Follow the regulations regarding seasons and catch limits and report poachers through your provincial or territorial wildlife agency or the RCMP or Crime-stoppers. Develop your identification skills to avoid killing endangered species (e.g., the Eastern Harlequin Duck) and teach other hunters to do the same. Be sure of your game and avoid wastefulness. Practice catch and release of fish if you are not going to eat them.
- When you boat, stow your trash and dispose of it safely or recycle it ashore. Never throw it overboard. Report suspicious-looking industrial discharges, fish kills, and other environmental problems to your provincial, territorial, or federal wildlife agency. Do not spill gas and oil into the water; avoid stirring up bottom sediments with propellers; keep personal watercraft out of shallow areas that are critical habitat for spawning fish, aquatic plants, and aquatic invertebrates; and keep speeds down to avoid creating a wake that could disturb shoreline habitat.
- When fishing, do not dump minnows into the water. Alien fish species and zebra mussels can be spread in this way, upsetting the balance of ecosystems. Follow locally posted guidelines about cleaning the hull of your boat before moving it out of an area infested with zebra mussels.
- When camping, heed the forest fire risk notices before lighting campfires, do not dump dishwater directly into lakes and rivers, and keep noise levels down.
- When choosing outdoor recreational activities, consider cross-country skiing and canoeing instead of snowmobiling and motor boating. These activities are quieter so they don't disturb wildlife, and they increase your chances of seeing wildlife. Remember that loud noises in winter disturb animals at a time when they need to rest and conserve energy.
- Participate in the land-use planning process in your community to ensure that wildlife habitat, especially habitat for endangered species, is protected.
- Teach others what you know.



Preventing and cleaning up pollution will help wildlife. This gull has become entangled in a plastic six-pack holder.

The special role of the landowner

Whether your land holdings are a small lot in a big city or a vast farm in the Prairies, there's a great deal you can do to make your land a haven for wildlife.

Abandoned farmland or a bare city lot can be improved by planting to attract wildlife. Plant a mixture of species so that many different types of animals can find food and shelter. In general, planting trees is a good idea, but not every open site should be forested. Before planting trees, make sure that you are not eliminating an important natural opening that supports diverse and unusual plants. Natural prairies have been destroyed through thoughtless reforestation projects in parts of Canada. Ask a naturalist or botanist to look your land over before you begin.

On forest land, link forest patches with corridors of trees and shrubs to allow wildlife to move under cover. Remember to use native species. Our songbirds take more readily to a familiar thicket of native dogwood or willow than to introduced, exotic species such as weeping mulberry. Native species provide food as well as cover, and are not as likely to dominate other native plants as introduced species often do.

Planting trees and shrubs is particularly critical along bare river and stream banks and lakeshores. Vegetation will prevent the banks from eroding into the stream, where the soil can destroy fish spawning beds. It will also absorb agricultural chemicals, thereby preventing them from going into the water where they can poison stream animals and overfertilize the aquatic habitat. Planting hedgerows of trees and shrubs around agricultural fields also provides sheltered corridors for wildlife to travel along and helps to prevent soil erosion. (However, hedgerows can be deathtraps if planted next to areas of intensive pesticide use.)

When cleaning up your property, think about how wildlife might use it. Rabbits, rodents, and birds will use brush piles for

cover. Manage your woodlot with wildlife in mind. For example, standing dead trees or "snags" play a wide variety of wildlife roles. Insects live in the wood; fungi break it down. Fungi and insects provide food for other creatures. Pileated Woodpeckers will visit the snag to feast on the insects or make nesting holes. These, in turn, eventually become homes for cavity-nesters like other woodpeckers, Wood Ducks, flying squirrels, and raccoons. Even after the tree falls, it has an important role to play for wildlife: salamanders, small rodents, and a variety of invertebrates and other organisms will live under it. Ants will live in it. If the tree falls over a stream, it will provide shade and cover for fish.

Because old trees are still wrongly considered useless and inherently dangerous by many people, there can be a shortage of snags for wildlife in some areas. Nest boxes provide a short-term solution to this problem, replacing the nesting cavities that snags would provide. Eastern Bluebird and Wood Duck populations have come back in North America thanks to hundreds of landowners who provided nest boxes for them. You can also put out boxes for chickadees, wrens, and kestrels; roosting boxes for bats; and posts with platforms for raptors. The long-term solution is the preservation of a mixture of healthy, dying, and dead trees in managed forests and elsewhere, as long as the snags are not a hazard to people or property.

Prairie farmers have plenty of opportunities to improve the wildlife value of their land. Thousands of prairie sloughs have been drained by farmers over the past century, especially during the last 30 years, and hedgerows have been removed. One incentive for this was to enable big modern machinery to operate in straight lines rather than having to go around water areas and woody vegetation. As well, government support programs were based on the amount of ploughed land, so that it paid to increase acreage, even if the newly ploughed land yielded very little. But before long, farmers were finding that the water table had dropped, and the once-rich land was becoming arid. The destruction of sloughs also caused a great decline in duck populations to levels lower than they were even during the great drought of the 1930s.

Now, many farmers are partners in the Prairie Habitat Joint Venture of the North American Waterfowl Management Plan (NAWMP), which aims to conserve upland and wetland habitat for waterfowl populations. All NAWMP partners, including the Canadian Wildlife Service, Ducks Unlimited Canada, and Wildlife

Habitat Canada, depend upon the cooperation of individual landowners who are willing to modify their agricultural practices to restore the prairie sloughs and improve the hydrology of their land, and in the process, help ducks, geese, swans, and other wildlife.

Agricultural practices are also responsible for a decline in populations of Burrowing Owls, which are an endangered species in Canada. With its habit of nesting underground in old mammal burrows, this diminutive owl needs land that is undisturbed by the plough. It also needs a source of pesticide-free insects. Many Alberta and Saskatchewan farmers are now leaving areas unploughed and unsprayed and are building underground nest boxes to create desperately needed habitat for the owls.

Even city dwellers can encourage wildlife to visit. *If you do not use pesticides*, plant native wildflowers to attract butterflies to your yard and put up bird feeders and bird baths. If you provide bird feeders or nest boxes be sure to thoroughly clean them periodically. Hummingbird feeders should be checked and cleaned frequently as the sugary syrup may ferment into alcohol and cause liver cirrhosis. Use bread and other baked goods sparingly as bird food and put them in the compost when they are mouldy; mouldy food is not good for songbirds. Feeding ducks breadcrumbs is a popular pastime, but remember that ducks eating bread will feel full and not seek more nutritious food. Ducks have died of malnutrition from eating bread instead of the aquatic plants and invertebrates that are their natural diet.

Gardeners and farmers help wildlife when they avoid the use of herbicides and pesticides. Although in Canada chemicals that break down into harmless substances soon after application have mostly replaced the long-lived chemical pesticides like DDT that accumulated in wildlife, these new pesticides are still poisonous during their brief lifetime. Many birds die every year after feeding on fields, lawns, or golf courses immediately after treatment with short-lived pesticides. Report harm to birds or other nontarget wildlife following pesticide use in writing to the Canadian Wildlife Service (Fax: 819.953.6612; Web: www.cws-scf.ec.gc.ca). Look for less harmful ways to control "weeds" and insects, or live with them — crabgrass and wasps are wildlife too.

Finally, there is a growing land trust movement in Canada, in which landowners agree not to develop their land, but to leave it in a natural state. If there is a land trust movement in your area, you could

join it. If not, consider starting one. Since 1995, over 200 Canadians have donated lands and conservation easements valued at \$25 million to conservation organizations under the National Ecological Gifts Program administered by Environment Canada. Information on this tax assistance initiative is available on the Web at www.cws-scf.ec.gc.ca.

Working for wildlife through organizations

If you wish to get involved in helping wildlife through an organization, here are some suggestions.

Keeping track of wildlife populations: survey and inventory work

Wild animals become less or more numerous in response to changes in their environment. Keeping track of numbers of a particular bird or mammal in Canada and monitoring the state of health of each species is important. Because governments cannot afford to pay for all the research that is needed, volunteers and amateur naturalists have an important role to play. Some knowledge of wildlife is necessary for those who conduct the surveys, but there are also many essential tasks, such as typing, driving, record-keeping, and construction, that require little more than a keen interest.

Thousands of Canadians take part every year in the continent-wide Christmas Bird Count. During about 17 days from mid-December to early January, teams of birdwatchers find, count, and report as many birds as possible in their circle on that day. Feeder watchers monitor the birds at their feeders. Each Christmas Bird Count is organized locally, usually by a naturalist club. The information collected about species and numbers of birds is fed into a computer along with results from the U.S. and Mexican Christmas Bird Counts. Many people think it is necessary to be an expert birder to take part in the Christmas Bird Count. But even beginning birders can participate by joining a small group that includes an experienced birder. If you develop your birdwatching skills, including your ability to recognize bird songs and calls, to the expert level, you could be assigned a route in the spring Breeding Bird Survey (BBS) or take part in the Canadian Wildlife Service's Forest Bird Monitoring Program. Biologists and conservationists use the results of the BBS to determine population trends of birds throughout North America. The purpose of the newer Forest Bird Monitoring Program is to determine population trends of

By choosing the right plants you can encourage wildlife to visit your backyard. For example, butterflies tend to be attracted to purple, blue, yellow, and pink flowers.

Drawing by Wendy Kramer.



woodland birds and recommend ways to manage forest lands to benefit birds.

You can also make a contribution to bird surveys by simply keeping track of the birds that visit your feeder. Project Feeder Watch, organized by Bird Studies Canada (BSC), asks volunteers to count species and individuals for two consecutive days every two weeks, fill the information in on a form, and send it to BSC at the end of winter.

In recent years, many new wildlife surveys that invite public participation have sprung up. They include Frogwatch and Wormwatch in which Environment Canada's EMAN (Environmental Monitoring and Assessment Network) participates along with the Canadian Wildlife Federation, CWF's coast-to-coast Butterfly Survey, BSC's Canadian Lakes Loon Survey and Owl Monitoring, and Plantwatch, coordinated by the Devonian Botanic Garden of the University of Alberta. There are several lists of wildlife surveys on the Web. The Canadian Wildlife Federation list is at <http://www.cwf-fcf.org/surveys/survey51.htm>.

Helping wildlife at risk

Canada's special-concern, threatened, and endangered species are particularly in need of our help. Government programs have brought some of these species, notably the Whooping Crane, White Pelican, and wood bison, back from the brink. But there are also local organizations helping endangered wildlife, such as the Piping Plover guardianship programs in the Atlantic and Prairie provinces. After a training session on the basics of Piping Plover biology, community members go to beaches to guard the nesting areas of this endangered species, inform the public about the bird, ask users of the beaches to avoid nests, and record the species' distribution and reproductive success.

Habitat protection also helps at-risk wildlife. The Karner blue butterfly of southwestern Ontario lives on lupine and butterfly weed, but the species has become endangered as its host plants are disappearing in this highly populated and intensively cultivated part of Ontario. Lambton Wildlife Inc., a Sarnia naturalist club, bought suitable land and created the Karner Blue Sanctuary. The club is re-establishing the required plant species, and hopes to reintroduce larvae of the butterfly.

If you identify an endangered species outside its known range, report your sighting to local wildlife authorities. All sightings of the endangered Whooping Crane should be reported by phone to 1.800.668.6767.

To learn more about species at risk and what recovery teams are doing to help them, visit the RENEW Web site at <http://www.cws-scf.ec.gc.ca/sara/efforts/index.htm>. RENEW stands for Recovery of Nationally Endangered Wildlife, the national recovery program.

Show your support

Even if you don't want to join a group, you can still support a conservation group that you feel is doing a good job of protecting wildlife. A letter to the organization, a letter to a newspaper, or a financial donation can encourage others to continue to work on behalf of wildlife.

For further information

Bird Studies Canada, P.O. Box 160, Port Rowan, Ontario N0E 1M0
(Tel.: 1.519.586.3531
Web: www.bsc-eoc.org/bscmain.html)

- Programs: Project Feederwatch, Canadian Loon Lakes Survey, Owl Monitoring
Canadian Wildlife Service, Environment Canada, Ottawa Ontario K1A 0H3
(Tel.: 1.819.997.1095
Web: www.cws-scf.ec.gc.ca)
- Programs: Breeding Bird Survey and the Forest Bird Monitoring Program (For information on these programs write to the BBS Coordinator at the above address or call 1.819.953.1425)
- Recommended publications: *Ecological gifts: a checklist for donating ecologically sensitive land in Canada* and the Hinterland Who's Who series including *Bird feeding* and *Pesticides and wild birds*.

Canadian Nature Federation, 1 Nicholas St., Suite 606, Ottawa, Ontario K1N 7B7 (Tel.: 1.613.562.3447
Web: www.cnf.ca)

- Programs: BIRDQUEST (there is an excellent list of recommended books and audiovisual material for learning about birds in BIRDQUEST).

Canadian Wildlife Federation, 350 Michael Cowpland Dr., Kanata, Ontario K2B 1A2
(Tel.: 1.800.563.9453
Web: www.cwf-fcf.org)

- Programs: Habitat 2000 and Project Wild
- Recommended publications: *Build a bat house*, *Golden gardens: a gardening program for seniors* (Available on the Web at <http://www.cwf-fcf.org/pages/iyop.htm>), *Plant a butterfly garden*, *Recycle for birds*

Ducks Unlimited Canada, P.O. Box 1160, Oak Hammock Marsh, Manitoba R0C 2Z0 (Tel.: 1.800.665.3825)

The Nature Conservancy of Canada, 110 Eglinton Ave. W., Suite 400, Toronto, Ontario M4R 1A3
(Tel.: 1.416.932.3202
Web: www.natureconservancy.ca)

Wildlife Habitat Canada, 7 Hinton Ave. N., Suite 200, Ottawa, Ontario K1Y 4P1 (Tel.: 1.613.722.2090
Web: www.whc.org)

World Wildlife Fund Canada, 245 Eglinton Ave. E., Suite 410, Toronto, Ontario M4P 2Z7
(Tel.: 1.800.26.PANDA Toronto area: 1.416.489.8800
Web: www.wwf.ca)

In addition to the national organizations listed above, your provincial or territorial wildlife agency and the CWS office in your area can provide other information. For example, the Ontario Ministry of Natural Resources sells an 18-page booklet called *Landscaping for wildlife*. Call 1.416.314.2000 for information.

Canadian Wildlife Service

The Canadian Wildlife Service handles wildlife matters that are the responsibility of the Canadian government. These include protection and management of migratory birds as well as nationally significant wildlife habitat. Other responsibilities are endangered species, control of international trade in endangered species and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada Agency, and other federal agencies in wildlife research and management.

For more information about the Canadian Wildlife Service or its other publications, please contact:

Publications
Canadian Wildlife Service
Environment Canada
Ottawa, Ontario K1A 0H3
(819) 997-1095 (phone)
(819) 997-2756 (fax)
cws-scf@ec.gc.ca



Address for access to the Hinterland Who's Who on the Internet: <http://www.cws-scf.ec.gc.ca>

Également disponible en français sous le titre
Passer à l'action pour les espèces sauvages.

Published by authority of the
Minister of the Environment
© Minister of Public Works and Government Services
Canada, 1994, 2001
Catalogue number CW69-4/91-2001E
ISBN 0-662-29709-1
Text: Lorraine Brown
Revised by Susan Burns, 2000

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Canadian Wildlife
Service

Hinterland
Who's Who

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Whooping Crane



The pothole area south of Great Slave Lake is some 2,500 miles from the salt marsh of Black-jack Peninsula on the Texas coast of the Gulf of Mexico. These two widely separated areas have in common that they are essential to the survival of North America's rarest and most magnificent bird – the whooping crane (*Grus americana*).

Each spring the few remaining wild whoopers leave their wintering ground in the Aransas Refuge in Texas and wing their way north over Oklahoma, Kansas, Nebraska, the Dakotas, Saskatchewan, northeastern Alberta, and into the Northwest Territories. There, in Wood Buffalo National Park, between the headwaters of the Nyarling, Sass, and Klewi Rivers, they make their nests and rear their young. In September or early October they set their course southward again toward their wintering ground in Texas.

Appearance

The whooping crane is a large, satiny-white bird with a long neck, long, dark, pointed bill, and long, thin black legs. When erect, a large male stands more than five feet tall – the tallest of all North American birds. At close range it is an imposing and beautiful bird, with its cap of crimson skin, its bright yellow eyes, and its arched, drooping tail plumes.

In the air it is even more magnificent. The white wings measure six feet or more between the tips of the long, black flight feathers that fan out like fingers. In flight the head is extended forward like a lance, and the legs trail equally straight behind. In normal flight the great wings beat in powerful, slow rhythm, at about two beats per second, with a quick, strong upward flick. Normal flying speed is about 45 miles per hour. It has a loud, clear, bugle-like call.

The whooping crane and its relatives

There are about 14 species of cranes in the world, found on all continents except South America.

Two species are found in North America – the whooping crane and the sandhill crane. Sandhill cranes, smaller than whoopers, are grey and brown in colour, and relatively numerous.

Range and habitat

Whooping cranes have probably never been numerous. By 1850, there were probably only 1,500. Their winter range then extended from north Mexico through Texas to the Louisiana coast, with scattered groups on the Atlantic coast. They nested over a wide area from the southern end of Lake Michigan to the Peace River country of Alberta, with scattered breeding population throughout the Mackenzie River system and northward to the Arctic coast.

In contrast to this original large range, the present known range of the whooping crane is tiny. The nesting area is 500 square miles and wintering ground only about 15 square miles.

Whooping cranes have exacting territorial requirements. In winter they select an area of salt marsh which they defend against other cranes and which provides all their food: blue crabs, crayfish, freshwater minnows, mullet, and aquatic insects like dragonflies, beetles, and water boatmen. These winter territories average over 400 acres per pair.

The whooping crane's requirements for nest area are also rigid. Each pair needs a considerable area of shallow water or marsh, with sedge, grasses, bulrushes, and abundant water animals and insects for food. This need for isolation and a specialized environment made their great nesting range unsuitable with the coming of settlement. Under pressure of farming, cattle grazing, settlement, hunting, even egg collecting, whooping cranes disappeared from central North America.

Since 1922, when a pair nested near Davids, Saskatchewan, not a single nest has been found in settled regions; in fact, for nearly three decades, until 1954, the whereabouts of the nesting ground remained a mystery. It was discovered accidentally when a forestry officer and a helicopter pilot, G. M. Wilson and J. D. Landells, carrying equipment to a forest fire, spotted a young bird with two adults south of Great Slave Lake. This sighting was confirmed the next day, and the location of the nesting ground definitely established by ground search in 1955.

Habits and life history

Although capable flyers, whooping cranes seem equally at home on the ground, spending about half their daily lives walking about in sloughs, marshes, and low-lying flat areas in search of food.

In fine, calm weather they may fly, apparently for pleasure, sometimes rising a mile or more in great slow spirals, circling and whooping with their melodious Ker-loo, Ker-lee-oo. They may circle for an hour or more, dots in the blue sky.

Approximate nineteenth-century range of the whooping crane. Black line indicates present breeding and winter range and migration path.



barely perceptible to the observer below. They may descend in long spirals, or may swoop and dive quickly down to within 50 feet of the ground, finally settling to the ground on outspread wings. A crane in flight, seen at close range, with sunlight on its satin-white plumage, presents a magnificent picture of grace, strength, and beauty.

In mid-December the mating dances begin. The dance has several variations. In one the male pumps his head up and down in a series of bows, at the same time flapping his wings slowly and leaping lightly off the ground. He may bow until his bill almost touches the ground, then may raise his head and point his bill in the air at a steep angle, then bow again, and perhaps rotate a full or half circle, leaping, whirling, and fanning the air with his wings. The female sometimes participates in the dance. It is thought that the birds mate for life. The mating dance occurs annually, but with reduced intensity.

The whooping cranes usually leave their wintering grounds in the last week of March or the first half of April. They move north in 200- or 300-mile stages, and may rest for several days at staging areas in Nebraska or Saskatchewan. They may roost on river bars at night, and in the morning feed on the egg masses of frogs and toads or on other aquatic life. Often they walk over adjoining fields seeking beetles and other insects.

By the first or second week of May the nesting pairs arrive at their nesting grounds. Mated pairs dance on the nesting area and while nest building. Not all the cranes are breeding birds. There is evidence that the cranes do not breed until they are at least two years of age or older. Others may be past breeding age. Still others may not be able to find a mate in the very small population that now exists.

The nesting area, like the Texas wintering grounds, is a low-lying area of marsh, sloughs, and mud flats, much of it grown to bulrushes, sedges, cattails, and other semi-aquatic plants. The area is nearly inaccessible to man except by aircraft. These sloughs and marshes contain abundant food: a few small fish such as brook stickleback and fat-head minnows, and many wood frogs, chorus frogs, and many species of molluscs, especially snails and small clams. Insects of the area include dragonflies, damselflies, may-flies, backswimmers, and many diving beetles, water mites, caddis flies, and bristle-worms. The nymphs of the first three undoubtedly form a large part of the cranes' spring and early summer diet.

The nest is usually set in 15 or 16 inches of water, but may be on firm ground near water. It is built of rushes and reeds, with a covering layer of grass and rises 10 to 15 inches above the water surface.

The female usually lays two eggs, but occasionally only one. The shells are smooth and

somewhat glossy. The colour varies from cream buff to olive buff, and is blotched quite heavily near the large end with various shades of brown. Only one egg is raised, although both may hatch. The second chick either dies or is destroyed. It seems that there is not room on the high-crowned nest for more than one chick.

The incubation period lasts about 34 days. One bird is always on the nest or closely guarding it. The male takes his turn at incubating and always seems preoccupied with guarding the nest. He will fly or run at any invader, uttering loud whooping noises, and is well able to chase away coyote, fox, raven, eagle, bittern, or other intruder. The reddish-yellow young hatch during the second week of June. From then until about December the parents capture food for the young birds. They often break shellfish and snails to prepare them for eating by the young birds.

The young birds practise flying in September and by late September or early October are ready to try their wings on the long 2,500-mile journey southward. The young of the year are not as large as the adult birds, and their plumage is buff, cinnamon, and russet mixed with white.

Young whoopers may be easily mistaken for sandhill cranes. In this resemblance lies one of the dangers to the whooping crane. Shooting of sandhill cranes – either with a depredation licence or in special limited seasons – is permitted in some areas but under careful supervision, and the licence or season is terminated if a whooper is observed in the area. However, there is still the danger that an illegal or unknowing hunter will shoot a whooping crane, particularly a young one.

The young remain with their parents during the first winter on the refuge. They make the return flight north alone and unfortunately mortality is very high, probably owing to the young birds' inexperience. Biologists do not know exactly what mortality factors affect the young birds, but few reach the nesting grounds.

Management and preservation

Naturalists had been concerned for many years that this great bird might become extinct. Destruction of habitat was the main reason for the decline of the whooping crane to less than 100 in the 1920's. In 1937 the United States Government established the National Wildlife Refuge at Aransas to preserve at least a remnant of winter range suitable for the whooping cranes.

Whooping cranes were hunted openly up to the early 1900's but were never numerous enough to be an important sport species. The birds were protected by law in 1918, but nonetheless the population continued to decrease. In 1941, the total continental population was down to 15, and at that time it appeared almost inevitable that the whooping crane would become extinct within a few years.

Recognizing this danger, a number of naturalists and biologists began a campaign to save



the species. The cranes have responded by gradually increasing, but survival of the species is still precarious.

By 1956 the total world population of whooping cranes had risen to 27 – 24 in the wild and three in captivity. From that low point it climbed very slowly to a total of 50 in 1966. But the risk that the entire wild population might be wiped out by a violent storm remained very great.

The Canadian Wildlife Service and the U.S. Bureau of Fisheries and Wildlife decided to attempt to build up a captive flock by artificially incubating eggs taken from whooping crane nests in Wood Buffalo Park. The first pick-up occurred in 1967 when a team of scientists from the two agencies took six eggs from nests and flew with them by jet aircraft to a special rearing station at Patuxent, Maryland. Ten more eggs were picked up in the following year and 10 in 1969. There was no pick-up in 1970. It is hoped that the captive flock hatched from the eggs, which totalled 22 in 1970, will increase to a point where some young birds can be released to the wild.

The cranes' long struggle for survival has many years to go before the population is at a safe level. If the battle for survival is won, the North American public will have reason for some self-satisfaction. However, the whooping crane has been fortunate because its plight has been dramatized and public opinion effectively mobilized in its support. Other lesser known endangered species also require the devoted research and management that the whooping crane has received if they are not to become extinct. All species are part of our natural heritage, and their preservation is scientifically and aesthetically desirable.

Reading list

- Allen, R. P. 1952. The whooping crane. National Audubon Society. Research Report No. 3.
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Novakowski, N. S. 1966. Whooping crane population dynamics on the nesting grounds, Wood Buffalo Park, Northwest Territories. Canadian Wildlife Service report series No. 1. Ottawa.

How does the Canadian Wildlife Service fit into the national wildlife picture?

The Canadian Wildlife Service carries out both wildlife research and management. As a branch of the Department of Indian Affairs and Northern Development, it is entrusted with federal responsibilities for wildlife, a renewable resource

of ever-increasing importance to the national welfare and economy.

Each province controls the natural resources within its boundaries, including wildlife. However, because Canada signed the Migratory Birds Treaty with the United States in 1916, there is a federal responsibility for the management and protection of migratory birds. The Canadian Wildlife Service administers the Migratory Birds Convention Act and Regulations for the federal government. In practice, federal and provincial governments co-operate in all matters concerning migratory birds. CWS studies migratory birds throughout Canada and conducts scientific research into other wildlife problems in the Northwest Territories, the Yukon Territory, and Canada's national parks; it also co-operates with administrative agencies when wildlife management programs indicated by research are instituted.

The CWS staff includes mammalogists, ornithologists, limnologists, pathologists, a biometrician and a pesticides unit. The head office is in Ottawa; regional offices are located in Edmonton and Ottawa, with smaller offices across Canada, from Whitehorse, Yukon Territory, to St. John's Newfoundland.

CWS administers over 90 migratory bird sanctuaries throughout Canada and it is participating with the provinces in a major program of preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program, in effect since April 1966, provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province, please contact the director of your provincial fish and wildlife department.

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WHO'S WHO

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CANADIAN WILDLIFE SERVICE



Whooping crane. Credit U.S. Fish and Wildlife Service

The whooping crane

(Grus americana)

The pothole area south of Great Slave Lake is some 2,500 miles from the salt marsh of Blackjack Peninsula on the Texas coast of the Gulf of Mexico. These two widely separated areas have in common that they are essential to the survival of North America's rarest and most magnificent bird – the whooping crane.

Each spring the few remaining wild whoopers leave their wintering ground in the Aransas Refuge in Texas and wing their way north over Oklahoma, Kansas, Nebraska, the Dakotas, Saskatchewan, northeastern Alberta, and into the Northwest Territories. There, in Wood Buffalo National Park, between the

headwaters of the Nyarling, Sass, and Klewi Rivers, they make their nests and rear their young. In September or early October they set their course southward again toward their wintering ground in Texas.

In February 1968 there were 58 whooping cranes of which 11 were in captivity. As recently as the autumn of 1956 there were only 24 wild birds. In 1941, the total continental population was down to 15, and at that time it appeared almost inevitable that the whooping crane would become extinct within a few years.

Recognizing this danger, a number of naturalists and biologists began a campaign to save the species. The cranes have responded by gradually increasing, but survival of the species is still precarious.

General appearance

The whooping crane is a large satiny-white bird with a long neck, long dark pointed bill, and long thin black legs. When standing erect, a large male stands more than five feet tall – the tallest of all North American birds. At close range it is an imposing and beautiful bird, with its cap of crimson skin, its bright yellow eyes, and its arched, drooping tail plumes. In the air it is even more magnificent. The white wings measure six feet or more between the tips of the long, black flight feathers that fan out like fingers. In flight the head is extended forward like a lance, and the legs trail equally straight behind. In normal flight the great wings beat in powerful, slow rhythm, at about two beats per second, with a quick, strong upward flick. Normal flying speed is about 45 miles per hour. It has a loud, clear, bugle-like call.

The whooping crane and its relatives

Cranes belong to the order of birds known scientifically as the Gruiformes. In the same order are the rails, coots, gallinules, bustards, sun-grebes, and sun-bitterns.

There are about 14 species of cranes in the world. Cranes are found on all continents except South America. Two species are found in North America – the whooping crane and the sandhill crane. Sandhill cranes, smaller than whoopers, are grey and brown in colour. Sandhill cranes are gregarious and their habitat requirements are less specialized. They are relatively numerous.



Approximate nineteenth-century range of the whooping crane. Black line indicates present breeding and winter range and migration path

Range and habitat

Whooping cranes have probably never been numerous. By 1850, there were probably only 1,500. Their winter range then extended from north Mexico through Texas to the Louisiana coast, with scattered groups on the Atlantic coast. They nested over a wide area from the southern end of Lake Michigan to the Peace River country of Alberta, with scattered breeding populations throughout the Mackenzie River system and northward to the Arctic coast.

In contrast to this original large range, the present known range of the whooping crane is tiny. The nesting area is 500 square miles and the wintering ground only about 15 square miles.

Whooping cranes have exacting territorial requirements. In winter they select an area of salt marsh which they defend against other cranes and which provides all their food: blue crabs, crayfish, freshwater minnows, mullet, and aquatic insects like dragonflies, beetles, and water boatmen. These winter territories average over 400 acres per pair.

The whooping crane's requirements for nesting are also rigid. Each pair needs a considerable area of shallow water or marsh, with sedge, grasses, bulrushes, and abundant water animals and insects for food. This need for isolation and a specialized environment made their great nesting range unsuitable with the coming of settlement. Under pressure of farming, cattle grazing, settlement, hunting, even egg collecting, whooping cranes disappeared from central North America. It has been estimated that the whooping crane population declined 90 per cent from 1870 to 1900.

Since 1922, when a pair nested near Davidson, Saskatchewan, not a single nest has been found in settled regions; in fact, for nearly three decades, until 1954, the whereabouts of the nesting ground remained a mystery. It was discovered accidentally when a forestry officer and a helicopter pilot, G. M. Wilson and J. D. Landells, carrying equipment to a forest fire, spotted a young bird with two adults south of Great Slave Lake. This sighting was confirmed the next day, and the location of the nesting ground definitely established by ground search in 1955.

Habits and life history

Although capable flyers, whooping cranes seem equally at home on the ground, spending about half their daily lives walking about in sloughs, marshes, and low-lying flat areas in search of food.

In fine, calm weather they may fly, apparently for pleasure, sometimes rising a mile or more in great slow spirals, circling and whooping with their melodious *Ker-loo, Ker-lee-oo*. They may circle for an hour or more, dots in the blue sky barely perceptible to the observer below. They may descend in long spirals, or may swoop and dive quickly down to within 50 feet of the ground, finally settling to the ground on outspread wings. When flying aloft they may execute many graceful patterns of flight, flying in circles, forming sides, crossing over and back, and almost seeming to dance in mid-air. A crane in flight, seen at close range, with a flash of sunlight on its satin-white plumage, presents a magnificent picture of grace, strength, and beauty.

In mid-December the mating dances begin. The dance has several variations. In one the male pumps his head up and down in a series

of bows, at the same time flapping his wings slowly and leaping lightly off the ground. He may bow until his bill almost touches the ground, then may raise his head and point his bill in the air at a steep angle, then bow again, and perhaps rotate a full or half circle, leaping, whirling, and fanning the air with his wings. The female sometimes participates in the dance. It is thought that the birds mate for life. The mating dance occurs annually, but with reduced intensity.

The whooping cranes usually leave their wintering grounds in the last week of March or the first half of April. They move north in 200- or 300-mile stages, and may rest for several days at staging areas in Nebraska or Saskatchewan. They may roost on river bars at night, and in the morning feed on the egg masses of frogs and toads or on other aquatic life. Often they walk over adjoining fields seeking beetles and other insects.

By the first or second week of May the nesting pairs arrive at their nesting grounds. Mated pairs dance on the nesting area and while nest building. Not all the cranes are breeding birds. There is evidence that the cranes do not breed until they are at least two years of age or older. Others may be past breeding age. Still others may not be able to find a mate in the very small population that now exists. These non-breeding cranes are the summer wanderers. They may be seen singly or in small groups anywhere on the former summer breeding range of the whooping crane—perhaps on some Saskatchewan marsh, or in the Peace River country of Alberta. The nesting area, like the Texas wintering grounds, is a low-lying area of marsh, sloughs, and mud flats, much of it grown to bulrushes, sedges, cattails, and other semi-aquatic plants. The area is nearly inaccessible to man.

The many sloughs and marshes of the nesting area contain abundant food: a few small fish such as brook stickleback and fat-head minnows, and many wood frogs, chorus frogs, and many species of molluscs, especially snails and small clams. Insects of the area include dragonflies, damsel flies, mayflies, backswimmers, and many diving beetles, water mites, caddis flies, and bristle-worms. The nymphs of the first three undoubtedly form a large part of the cranes' spring and early summer diet.

The nest is usually set in 15 or 16 inches of water, but may be on firm ground near water. It is built of rushes and reeds, with a covering layer of grass, and rises 10 to 15 inches above the water surface.

The female usually lays two eggs, but occasionally only one. The shells are smooth and somewhat glossy. The colour varies from cream buff to olive buff, and is blotched quite heavily near the large end with various shades of brown. Only one egg is raised, although both may hatch. The second chick either dies or is destroyed. It seems that there is not room on the high-crowned nest for more than one chick. The production of two fertile eggs, only one of which is raised, is a form of natural "insurance" against destruction or loss of the first egg.

The incubation period lasts about 34 days. One bird is always on the nest or closely guarding it. The male takes his turn at incubating and always seems preoccupied with guarding the nest. He will fly or run at any invader, uttering loud whooping noises, and is well able to chase away coyote, fox, raven, eagle, bittern, or other intruder. The reddish-yellow young hatch during the second week of June. From then until about December the parents capture food for the young birds. They often break shellfish and snails to prepare them for consumption by the young birds. The young birds practise flying in September and by late September or early October are ready to try their wings on the long 2,500-mile journey southward. The young of the year are not as large as the adult birds, and their plumage is buff, cinnamon, and russet mixed with white.

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The young remain with their parents during the first winter on the refuge. They make the return flight north alone and unfortunately mortality is very high, owing to the young birds' inexperience. Biologists do not

know exactly what mortality factors affect the young birds, but few reach the nesting grounds.

Management and preservation

Naturalists had been concerned for many years about the possibility that this magnificent bird might become extinct. Destruction of habitat was the main reason for the decline of the whooping crane to less than 100 in the 1920's. The winter range had been seriously reduced by cattle grazing, fire, water pollution, and, in Louisiana especially, rice growing. In 1937 the United States Government established the National Wildlife Refuge at Aransas to preserve at least a remnant of habitat suitable for the whooping cranes.

Whooping cranes were hunted openly up to the early 1900's but were never numerous enough to be an important sport species. The birds were protected by law in 1918, but nonetheless the population continued to decrease. Early in the 1940's the National Audubon Society took action to stem the seemingly inevitable march of the whooper toward extinction. The society sponsored a detailed biological investigation to accumulate enough knowledge about the crane to enable effective management. In the decade following 1945 federal, state, provincial, and private agencies throughout the migration route carried out an intensive publicity campaign to reduce accidental or intentional kill by hunters.

In early June 1967 a team of scientists from the U.S. Fish and Wildlife Service and the Canadian Wildlife Service took six eggs from Wood Buffalo National Park for artificial incubation. A biologist flown in by helicopter waded hip-deep in the muskeg to take one egg from each of six nests – thus leaving an egg to be hatched and raised by the parents. All the adult cranes returned to their nests. The eggs were flown to a special rearing station at Patuxent, Maryland. Unfortunately one hatched and died en route, and a second has subsequently died. The remaining four are doing well. The intention is to build up a captive propagating flock and eventually release offspring to bolster the wild population.

The cranes' long struggle for survival has many years to go before the population is at

a safe level. If the battle for survival is won, the North American public will have reason for some self-satisfaction. However, the whooping crane has been fortunate because its plight has been dramatized and public opinion effectively mobilized in its support. Several other lesser known species – such as the Eskimo curlew, the Ipswich sparrow, the greater prairie chicken – urgently require the devoted research and management that the whooping crane has received if they are not to become extinct. Few people realize that hawks, eagles, and owls in Canada could be exterminated. Being flesh eaters, they are at the end of a food chain, each link of which accumulates higher concentrations of chemical poisons, originally sprayed on crops to protect them from insect damage. All species are part of our natural heritage, and their preservation is scientifically and aesthetically desirable.

Reading list

- A report on the whooping crane's northern breeding ground. R. P. Allen. National Audubon Society. A supplement to Research Report No. 3. 1956.
- The whooping crane. R. P. Allen. Research Report No. 3. National Audubon Society. 1952.
- The whooping crane: the bird that defies extinction. Faith McNulty. Toronto, Clarke Irwin. 1966.
- Whooping crane population dynamics on the nesting grounds, Wood Buffalo National Park, Northwest Territories. N. S. Novakowski. Canadian Wildlife Service Report Series No. 1. 1966. Available from the Queen's Printer for 50¢.

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The Wildlife Service staff includes mammalogists, ornithologists, limnologists, pathologists, a pesticide investigator, and a biometrician. The head office is in Ottawa and there are regional offices in Edmonton and Ottawa. Smaller offices are located at Fort Smith and Inuvik, Northwest Territories; Whitehorse, Yukon Territory; Vancouver, British Columbia; Calgary, Alberta; Saskatoon, Saskatchewan; Winnipeg, Manitoba; Aurora, Ontario; Ste-Foy, Quebec; Fredericton and Sackville, New Brunswick; Halifax, Nova Scotia; and St. John's, Newfoundland.

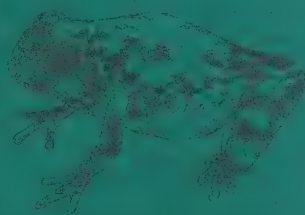
The Service administers 94 migratory bird sanctuaries throughout Canada. It is now participating with the provinces in a major program of preserving, by purchase and long-term lease, wetlands necessary to migratory birds for breeding and for resting during migration.

A National Wildlife Policy and Program was announced on April 6, 1966, that provides for expanded research and management in co-operation with the provincial game agencies and other interested organizations.

For further information on wildlife in your province please contact your chief provincial game officer.

Additional notes

Wetlands



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A member of the Environmental Conservation family

Canada



Canada is famous for its innumerable lakes and rivers, but travel folders seldom mention its marshes, swamps, and bogs or the many small ponds or sloughs that dot large areas of the country. These are called wetlands—a precious but threatened part of our heritage.

A wetland is simply any area of land that is covered with water for a part of the day or year. There are two classes of wetlands: freshwater and saltwater. The limits of freshwater wetlands are usually established in the spring, when water levels are highest because of melting snow and flooding. Summer droughts, evaporation, and infiltration will gradually cause the areas to dry up, sometimes completely. But even if wet for only a short time each year, the area is a wetland.

Saltwater wetlands, on the other hand, are usually caused by ocean tides. Some are flooded and dry up twice each day. Others are flooded only by particularly high tides that occur at less regular intervals.

Where are wetlands?

In Canada, wetlands are everywhere. They are found along the shores of oceans, lakes, and rivers, dotted across the prairies, and in countless, poorly-drained depressions in the Canadian shield. Look for them throughout river deltas and estuaries and near the shallow bays and inlets along our coasts.

Better known wetlands are the marshes in the Great Lakes Basin, bordering Lake St. Clair and Lake Erie, and along the shores of the St. Lawrence River. Large areas of wetlands are found in the Peace-Athabasca River delta in northern Alberta and the Saskatchewan and Red River deltas in Manitoba. Noteworthy too are the peatlands of Newfoundland and Vancouver Island and the large areas of muskeg in northern Canada.

The broad coastal areas of Hudson Bay and James Bay, the marshes at Kamouraska in Quebec, at Tintamarre in New Brunswick, and of the Fraser River estuary in British Columbia are among the better known saltwater wetlands.

But no wetlands are more remarkable than those of the prairie pothole region. This is an area of some 750 000 km² stretching across southern Alberta, Saskatchewan, and Manitoba.

This vast region is pitted with millions of depressions that vary considerably in size and depth. In the spring these depressions fill with water from melting snow and rain. Some of the larger ones form lakes or other permanent bodies of water, but the smaller depressions form innumerable temporary sloughs or potholes, many of them drying up in only a few weeks.

Types of wetlands

There are four major types of wetlands: ponds, marshes, swamps, and peatbogs. Each has its own characteristics.

A *pond* is a well-defined basin, filled with stagnant water and fringed with vegetation. It is fed mainly by rain and snowmelt and loses water through seepage and direct evaporation and during plant transpiration. During the summer, parts of a pond may dry out, exposing mudflats. The shallow

depth of a pond allows water lilies and other bottom-rooted plants to reach the surface, while milfoils, pondweeds, and other submergent plants flourish beneath.

A *marsh* is subject to periodic flooding, particularly if located near a river or lake, or in the case of saltwater marshes, near tidal waters. Consequently, its water level can change drastically. Its boundaries are not as well defined as those of a pond, and a marsh may dry out completely by late summer. A marsh is overgrown with coarse grasses, sedges, and rushes.

The water-filled potholes and sloughs of the prairies may resemble ponds or marshes, depending on their characteristics and specific locations.

A *swamp* is essentially a wooded marsh, a waterlogged area supporting trees, tall shrubs, herbs, and mosses. Still or gently flowing water covers much of the surface during wetter seasons.

A *peatbog* is a poorly drained area covered by mats of moss. The moss slowly decomposes in successive layers to eventually form a material called peat. There are two types of peatbogs: bogs and fens. In bogs, the process of decomposition and peat formation is further advanced than in fens, making the soil and water more acidic. The most common moss found on the surface of a bog is sphagnum moss. Other bog plants are sedges and low-growing shrubs of the heath family and sometimes trees such as spruce.

In fens, sedges are the predominant vegetation and sphagnum moss is not common, although other mosses that require less acidic conditions may grow there. Fens also support reeds, grasses, and low-to-medium height shrubs. Occasionally, too, there may be a sparse scattering of trees—tamarack or cedar. In northern Canada, a large expanse of bog or fen is called muskeg.

What good are wetlands?

It's easy to regard wetlands as mere wastelands, of little or no value. We don't build houses or factories in swamps, bogs, or marshes, and we don't plant wheat or many other crops on land submerged in water. Wetlands are generally unsuitable for boating, swimming—in fact, for most human activities.

So it's not surprising that many people "reclaim" our wetlands, by draining them or filling them in. To do so is a serious mistake.

Wetlands act like giant sponges, soaking up rain and snowmelt and slowly releasing water in drier seasons. Thus, they help to reduce floods and to ease the worst effects of drought. Draining ponds, sloughs, and marshes often lowers the water table and dries up wells. Wetlands also reduce soil erosion by checking or slowing the runoff from storms and thaws.



Without wetlands we would no longer have a ready supply of fresh drinking water. Much like our kidneys, wetlands filter the waters of our lakes, rivers, and streams, reducing pollution. The vegetation in wetlands removes phosphates and other plant nutrients washed in from the surrounding soil, thereby retarding the growth of algae and aquatic weeds. This growth is a serious problem in some of Canada's major waterways where dead and decaying algae rob the deeper waters of their oxygen.

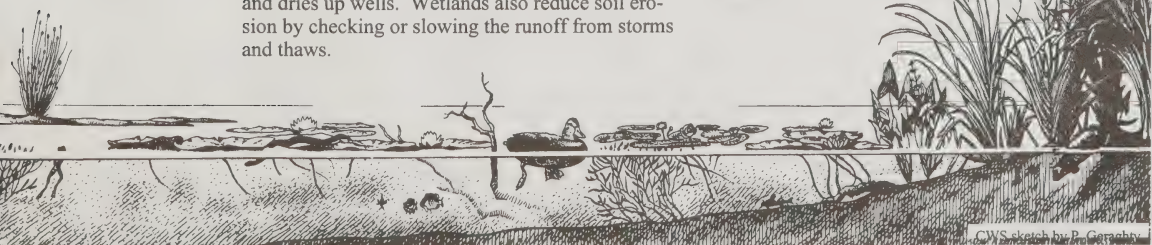
Wetlands are also the homes for at least some part of the year for many fish, birds, and other animals, meeting essential breeding, nesting, nursery, and feeding needs. Without wetlands, some wildlife species would disappear.

Wetlands contribute to the growth and economy of the country. Some of the smaller mammals, such as the beaver and muskrat, that dwell in wetlands are important to the fur trade, and the millions of game birds and fish reared in and around our wetlands support a growing recreation and tourist industry.

Creatures large and small

A wetland who's who would list many creatures, ranging in size from the microscopic one-celled protozoa to the massive moose. Some are born and live out their entire lives in wetlands; others spend only part of each day or a part of their life there.

Wetlands are the whole world for many salamanders, snakes, turtles, and aquatic insects. On the other hand, many of our frogs, toads, and tree frogs breed in temporary ponds and marshes, but spend much of their adult life on the surrounding dry land. Fish, such as stickleback and pike, come to marshes to spawn and feed in the shallow waters.



Among the smaller mammals living around the marsh are shrews, lemmings, voles, muskrats, and beavers. Predators include mink, otters, bobcats, and the elusive cougar and grey fox.

But wetlands are especially a boon for birds. More than 100 species inhabit or make use of Canada's marshes, swamps, and sloughs. Some, like the Swamp Sparrow and Marsh Wren, nest there almost exclusively. Many millions of ducks, geese, gulls, and other waterfowl also nest, breed, and feed there along with numerous waders and shorebirds—herons, bitterns, rails, and sandpipers.

Kingfishers, owls, Ospreys, and other predators feed in wetlands. Birds such as Mallards and teal use wetlands while moulting because marshy areas provide excellent escape cover. Sandhill Cranes, geese, and Tundra Swans stop over in marshes during migration, to rest and feed and to regain their strength.

Waters of life

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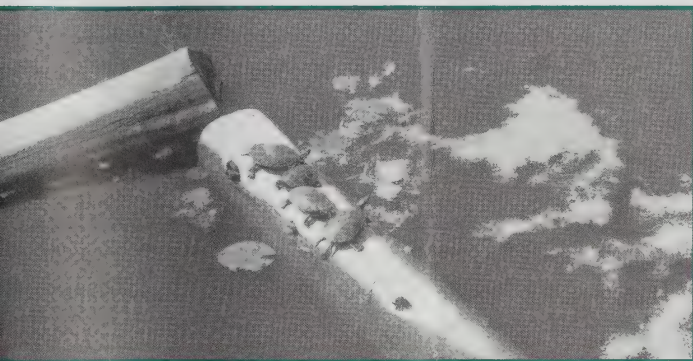
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Photo: Canadian Museum of Nature



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The Ecological Gifts Program

Since 1995, Canada's Ecological Gifts Program has encouraged landowners to conserve ecologically sensitive land by donating it to a qualified recipient. Donors know that their land will be cared for, and they also receive significant income tax benefits. For more information visit <http://www.cws-scf.ec.gc.ca/ecogifts/> or call 1-800-668-6767.





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For more information about the Canadian Wildlife Service or its other publications, please contact:

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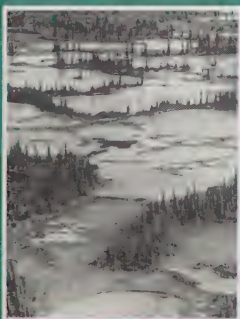
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Également disponible en français sous le titre
Les milieux humides.

Published by Authority of the
Minister of Environment
©Minister of Public Works and
Government Services Canada, 1980,
1989, 1999, 2002
Catalogue number CW69-4/75-2002E
ISBN: 0-662-31806-4
Sketches: S. Popowich*
Photos: CWS*
*Except where indicated otherwise

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Wetlands



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Canada is famous for its innumerable lakes and rivers, but travel folders seldom mention its marshes, swamps, and bogs or the many small ponds or sloughs that dot large areas of the country. These are called wetlands—a precious but threatened part of our heritage.

A wetland is simply any area of land that is covered with water for a part of the day or year. There are two classes of wetlands: freshwater and saltwater. The limits of freshwater wetlands are usually established in the spring, when water levels are highest because of melting snow and flooding. Summer droughts, evaporation, and infiltration will gradually cause the areas to dry up, sometimes completely. But even if wet for only a short time each year, the area is a wetland.

Saltwater wetlands, on the other hand, are usually caused by ocean tides. Some are flooded and dry up twice each day. Others are flooded only by particularly high tides that occur at less regular intervals.

Where are wetlands?

In Canada, wetlands are everywhere. They are found along the shores of oceans, lakes, and rivers dotted across the prairies, and in countless, poorly-drained depressions in the Canadian shield. Look for them throughout river deltas and estuaries and near the shallow bays and inlets along our coasts.

Better known wetlands are the marshes in the Great Lakes Basin, bordering Lake St. Clair and Lake Erie, and along the shores of the St. Lawrence River. Large areas of wetlands are found in the Peace–Athabasca River delta in northern Alberta and the Saskatchewan and Red River deltas in Manitoba. Noteworthy too are the peatlands of Newfoundland and Vancouver Island and the large areas of muskeg in northern Canada.

The broad coastal areas of Hudson Bay and James Bay, the marshes at Kamouraska in Quebec, at Tintamarre in New Brunswick, and of the Fraser River estuary in British Columbia are among the better known saltwater wetlands.

But no wetlands are more remarkable than those of the prairie pothole region. This is an area of some 750 000 km² stretching across southern Alberta, Saskatchewan, and Manitoba.

This vast region is pitted with millions of depressions that vary considerably in size and depth. In the spring these depressions fill with water from melting snow and rain. Some of the larger ones form lakes or other permanent bodies of water, but the smaller depressions form innumerable temporary sloughs or potholes, many of them drying up in only a few weeks.

Types of wetlands

There are four major types of wetlands: ponds, marshes, swamps, and peatbogs. Each has its own characteristics.

A *pond* is a well-defined basin, filled with stagnant water and fringed with vegetation. It is fed mainly by rain and snowmelt and loses water through seepage and direct evaporation and during plant transpiration. During the summer, parts of a pond may dry out, exposing mudflats. The shallow depth of a pond allows water lilies and

other bottom-rooted plants to reach the surface, while milfoils, pondweeds, and other submergent plants flourish beneath.

A *marsh* is subject to periodic flooding, particularly if located near a river or lake, or in the case of saltwater marshes, near tidal waters. Consequently, its water level can change drastically. Its boundaries are not as well defined as those of a pond, and a marsh may dry out completely by late summer. A marsh is overgrown with coarse grasses, sedges, and rushes.

The water-filled potholes and sloughs of the prairies may resemble ponds or marshes, depending on their characteristics and specific locations.

A *swamp* is essentially a wooded marsh, a waterlogged area supporting trees, tall shrubs, herbs, and mosses. Still or gently flowing water covers much of the surface during wetter seasons.

A *peatbog* is a poorly drained area covered by mats of moss. The moss slowly decomposes in successive layers to eventually form a material called peat. There are two types of peatbogs: bogs and fens. In bogs, the process of decomposition and peat formation is further advanced than in fens, making the soil and water more acidic. The most common moss found on the surface of a bog is sphagnum moss. Other bog plants are sedges and low-growing shrubs of the heath family and sometimes trees such as spruce.

In fens, sedges are the predominant vegetation and sphagnum moss is not common, although other mosses that require less acidic conditions may grow there. Fens also support reeds, grasses, and low-to-medium height shrubs. Occasionally, too, there may be a sparse scattering of trees—tamarack or cedar. In northern Canada, a large expanse of bog or fen is called muskeg.

What good are wetlands?

It's easy to regard wetlands as mere wastelands, of little or no value. We don't build houses or factories in swamps, bogs, or marshes, and we don't plant wheat or many other crops on land submerged in water. Wetlands are generally unsuitable for boating, swimming—in fact, for most human activities.

So it's not surprising that many people "reclaim" our wetlands, by draining them or filling them in. To do so is a serious mistake.

Wetlands act like giant sponges, soaking up rain and snowmelt and slowly releasing water in

drier seasons. Thus, they help to reduce floods and to ease the worst effects of drought. Draining ponds, sloughs, and marshes often lowers the water table and dries up wells. Wetlands also reduce soil erosion by checking or slowing the runoff from storms and thaws.

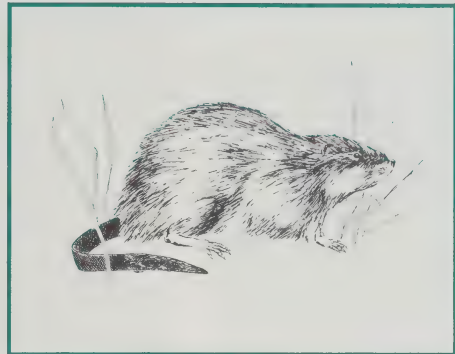
Without wetlands we would no longer have a ready supply of fresh drinking water. Much like our kidneys, wetlands filter the waters of our lakes, rivers, and streams, reducing pollution. The vegetation in wetlands removes phosphates and other plant nutrients washed in from the surrounding soil, thereby retarding the growth of algae and aquatic weeds. This growth is a serious problem in some of Canada's major waterways where dead and decaying algae rob the deeper waters of their oxygen.

Wetlands are also the homes for at least some part of the year for many fish, birds, and other animals, meeting essential breeding, nesting, nursery, and feeding needs. Without wetlands, some wildlife species would disappear.

Wetlands contribute to the growth and economy of the country. Some of the smaller mammals, such as the beaver and muskrat, that dwell in wetlands are important to the fur trade, and the millions of game birds and fish reared in and around our wetlands support a growing recreation and tourist industry.

Creatures large and small

A wetland who's who would list many creatures, ranging in size from the microscopic one-celled protozoa to the massive moose. Some are born and live out their entire lives in wetlands; others



spend only part of each day or a part of their life there.

Wetlands are the whole world for many salamanders, snakes, turtles, and aquatic insects. On the other hand, many of our frogs, toads, and tree frogs breed in temporary ponds and marshes, but spend much of their adult life on the surrounding dry land. Fish, such as stickleback and pike, come to marshes to spawn and feed in the shallow waters.

Among the smaller mammals living around the marsh are shrews, lemmings, voles, muskrats, and beavers. Predators include mink, otters, bobcats, and the elusive cougar and grey fox.

But wetlands are especially a boon for birds. More than 100 species inhabit or make use of Canada's marshes, swamps, and sloughs. Some, like the Swamp Sparrow and Marsh Wren, nest there almost exclusively. Many millions of ducks, geese, gulls, and other waterfowl also nest, breed, and feed there along with numerous waders and shorebirds—herons, bitterns, rails, and sandpipers.

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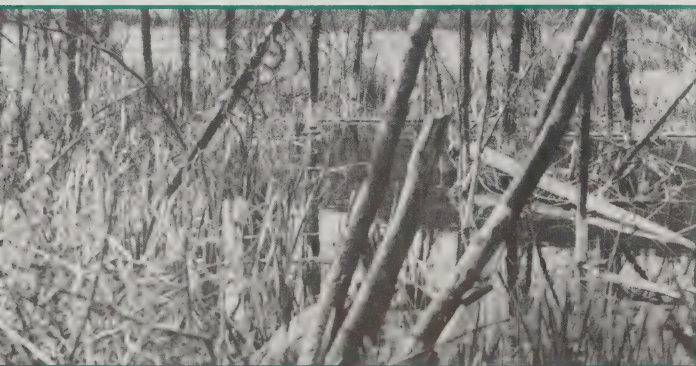


Photo: Canadian Museum of Nature



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Également disponible en français sous
titre *Les milieux humides*

Published by Authority of the
Minister of the Environment
©Minister of Supply and Services
Canada, 1980, 1989
Reprinted 1993
Catalogue No. CW69-4/75E
ISBN: 0-662-16671-X
Sketches: S. Popowich*
Photos: CWS*

* Except where indicated otherwise

HINTERLAND WHO'S WHO

AMERICAN ROBIN



This bird

- is the largest thrush in North America
- is one of the first birds to sing in the morning and is one of the last to be heard at night
- roosts in groups of up to 250 000
- has an esophagus that expands to allow it to store food
- makes an average of 180 trips a day when it builds its nest

Description

The American Robin *Turdus migratorius* is one of the best-known birds in North America. It was given its name by the early settlers, who thought that, with its reddish breast, it resembled the English Robin. However, the American Robin is a thrush, not a robin, and except for the colour of its breast, it does not look like the small brown European bird.

The American Robin is the largest thrush in North America. The adult measures about 25 cm long and weighs about 77 g. In addition to its cinnamon-rufous to brick-red breast, the American Robin has a black head, white eye-rings, yellow bill, black and white streaked throat, and grey back. The male is generally more brightly coloured than the female.

Young birds assume a mouse-grey down shortly after hatching. This is replaced by

feathers which make them resemble their parents, except for black spots on their breasts and pale streaks on their bodies. By October of their second year, they cannot be told apart from their elders.

Signs and sounds

The American Robin has a large repertoire of songs and calls. It is one of the first birds to begin singing in the morning and one of the last to be heard at night. The male is the most vocal, usually singing from high vantage points mainly in the morning and most frequently during courtship. He continues to sing until the young hatch, when he generally stops, resuming after the young fledge, or begin to fly. Perhaps the best-known song is the familiar "cheerily" carol: *cheerily, cheer up, cheer up, cheerily, cheer up*. The mating song is similar and is accompanied by the male displaying and lifting his tail higher than his head. The territory or whisper

song, *bisselly-bisselly*, is soft and ventriloquistic.

In addition to their singing, robins make a variety of calls, from the well-known alarm *cheep* and disturbed *tuktuk* to a scolding chirp accompanied by tail jerking. Some birds sing in July and August, when they are moulting, or replacing their feathers, but the songs become shorter and quieter, except for a brief resurgence at the end of September. While most singing stops by the end of October, singing can be common in the winter. Calls continue throughout the year.

Habitat and habits

The American Robin was originally a forest species, but it has adapted well to residential areas, where it feeds on lawns and nests in gardens and city parks. As trees have been planted, it has invaded the prairies, and it is often found in alpine forests and meadows above the treeline, so that there is scarcely any type of habitat, except marshes, where the American Robin will not nest. It prefers to winter in open areas, but does live in pinewoods and orange groves.

Unique characteristics

Roosting, or resting in trees, is common, especially during the non-breeding

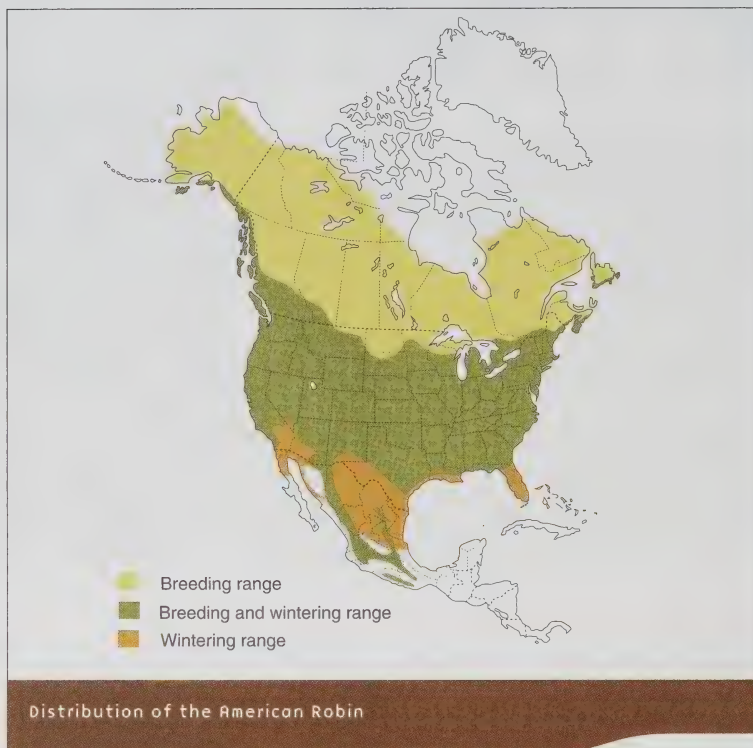
season. It seems that all American Robins gather in roosting communities in the winter, the adult males roost in the breeding season, the females after nesting is completed, and the young birds as soon as they can make the trip to the roosting area. Robin roosts can include as many as 250 000 birds, but they usually contain from 20 to 200 birds. Sometimes American Robins roost with other species, like European Starlings and Common Grackles. Roosting seems to be a way to protect against predators and to locate feeding areas, especially in winter, when the roosting groups travel about in search of food.

The American Robin has an extendible esophagus, or canal between the mouth and the stomach. This can be useful in winter, for example, when the bird may store fruits in the esophagus before it settles for the night. This probably allows the robin to survive low nighttime temperatures.

Range

The American Robin breeds north to Alaska, across Canada, and southward to the coast of the Gulf of Mexico in the United States and into southern Mexico. Northern populations migrate, spending the winter in an area that includes southwestern British Columbia and the Pacific coast of the United States, the south-central United States, the east coast of the continent as far north as the south coast of Newfoundland, and Mexico, southern Texas, and the tip of Florida in the south. In winter, robins share the edge of huge Red-winged Blackbird roosts with Common Grackles and starlings and feed with Cedar Waxwings. The southern races in the eastern United States and in Mexico do not migrate. Occasionally, when berries are abundant, a few hardy robins winter in Quebec, Ontario, and the prairies.

Migrating American Robins travel during the day. In the spring, they begin their northward movement in late February and do not arrive in any numbers in Canada until early March. The temperature rise in spring is a key factor in their migration, for the birds need thawing ground so that they can dig up earthworms. The northward migrants



follow closely an average daytime temperature of 3°C. American Robins return to the same breeding area they had frequented the previous year.

In the fall, on the other hand, robins do not follow a set "route." Instead of always returning to the same area, they seem to wander, responding to the seasonal availability of invertebrates and fruits, their main foods. They begin to migrate south in early September, but most wait until October, and large numbers pass through southern Canada in November. Birds seen in southern Canada as late as the second week of December may still be migrants. The birds usually migrate in small flocks, but may sometimes travel in groups of several hundred, frequently with Blue Jays.

Feeding

Most of us have seen American Robins on lawns, digging for and pulling up worms. However, earthworms provide only a part of the robin's diet. Although invertebrates—such as earthworms,

beetles, and caterpillars—provide about 40 percent of its diet, the robin is chiefly a fruit-eating species, with chokecherries, barberries, and rowan berries high on its list. Other favourites are sweet and sour cherries, wine grapes, and tomatoes. American Robins eat invertebrates mainly in spring and summer and fruit principally in fall and winter. Occasionally, robins eat small snakes and shrews, and they have even been known to comb the seashore at low tide for molluscs and go belly-deep in water to pick up fish fry. Although robins chiefly glean their food on the ground when hunting insects, or perch in trees while stripping fruit, they can also catch flying insects in midair. Young birds in the nest eat mostly earthworms and beetle grubs.

Breeding

American Robins begin to arrive at their breeding grounds in southern areas of Canada in early March and continue to arrive at northern breeding areas until as late as mid-May. Flocks of up to a dozen males arrive first as the snow recedes;

females sometimes arrive the same day but are usually a week, or even more, behind their mates. Robins generally remain together for the breeding season, but often mate with other individuals the following year. Most breeding adults return to the same general area each year, but young birds usually nest elsewhere.

Courtship is hard to define in the robin and usually takes place on the ground. Numerous fights occur during this period. Courtship includes courtship feeding, where the male feeds the female; ceremonial gaping, where the males and females approach each other and touch widely opened bills; and singing.

The male may visit the area where the nest will be located before the nest is built, and he may bring nesting material to his mate, but the female chooses the nest site and builds the nest. Although robins prefer to nest about 3 m above ground in spruce and maple trees, they readily adapt to a wide range of vegetation and built structures. They will even nest on the ground. Robins also reuse nests from the previous year, either their own or those of other species such as the Eastern Phoebe, the Catbird, the Common Grackle, and the Baltimore Oriole. Sometimes they build a new nest on top of an old one, which may have yet another nest under it, and lay the eggs in the new nest at the top.

The female makes the cup-shaped nest of mud mixed with grasses or small twigs and frequently with string, scraps of cloth, and small bits of paper. She works mud into place with her feet and bill, moulds it with her body, and lines the nest with fine grass. She takes from two to six days to build the nest, making an average of 180 trips a day, with mud or grass, during the peak building period. If the weather is bad, she may delay occupying the nest for as many as 20 days.

In southern Canada, the first clutch, or set of eggs, is laid in late April or early May. This is commonly followed by a second clutch and, at times, when conditions are favourable, a third. Nests may still contain eggs in early August. A clutch of three or four eggs is common.

The eggs are the familiar robin's-egg blue, though white ones, rarely brown spotted, do occur. The female generally begins incubating, or warming, the eggs after the last egg is laid, and she continues incubating for an average of 12 days. She usually sits on the eggs for 40-minute periods, then stands on the rim of the nest, turns the eggs, and flies off for a break. The male frequently stands guard when he is not in the feeding area and may occasionally sit on the eggs.

The nestling period lasts from 13 to 16 days. The next clutch is usually started about 40 days after the first egg of the year, but females often start the second nest, including laying the eggs, before the first group of young is independent. Sometimes the overlap is extensive, with the second clutch begun before the first nestlings are out of the nest. When this happens, the male cares for the first nestlings.

The young weigh about 5.5 g when they hatch. Fed by both parents, they each receive an average of 35 to 40 meals a day. The parents keep the nests clean by carrying away or eating the chicks' fecal sacs.

When they are about 13 days old, the young leave the nest, travelling up to 45 m on the first day. They may remain in the parents' territory for three weeks and may be fed by the male while his mate is on the next clutch. The young become independent of the parents at four weeks.

Conservation

Young American Robins do not have a strong chance of survival. It has been estimated that only 25 percent live until the beginning of November of their first year. Most birds live about two years, so that within six years, there is an almost complete turnover in population.

Robins have many predators. The chief one in residential areas is the domestic cat. In winter roosting areas, bobcats and Great Horned and Barred Owls take a toll. Other predators include raccoons, grey and red squirrels, chipmunks, hawks (especially the Sharp-shinned), crows, jays, grackles, and snakes, which prey on the eggs and young. External

parasites include lice, flies, ticks, and mites.

Robins do considerable damage to cherry and grape crops, and to olive orchards and tomato fields while on their American wintering grounds. At one time, people shot robins in the fall for the pot. Farmers still scare and shoot robins in orchards or in tomato or blueberry fields to prevent damage to the crops, but they must obtain a Permit Respecting Birds Causing Damage to do so, as these birds are protected under the *Migratory Birds Convention Act*.

A Canadian Wildlife Service biologist who studied methods of scaring birds away from dropped fruit found no effective and economical method. Acoustic bird-scaring devices and netting of grape vines are effective, but these cost far more than the damaged crops.

While they cause some crop damage, robins may also play a part in controlling insects, such as alfalfa weevils, which they eat in large quantities.

Unlike many species, the American Robin has adapted quite well to habitat disturbance. The loss of forests, the growth of urban areas, and the increase in the size of farms have created, rather than degraded, breeding habitat for this bird.

The American Robin continues to be well-loved, and the harbinger of spring to most communities in Canada.



Photo: Leslie M. Munn, Cornell

Resources

Online resources

Bird Studies Canada, Project Nest Watch,
American Robin Fact Sheet:
[http://www.bsc-eoc.org/national/
nw_robinsheet.html](http://www.bsc-eoc.org/national/nw_robinsheet.html)

Cornell Laboratory of Ornithology –
American Robin:
<http://birds.cornell.edu/BOW/AMEROB>

Journey North – American Robin:
[http://www.learner.org/jnorth/search/
Robin.html](http://www.learner.org/jnorth/search/Robin.html)

United States Geological Survey –
American Robin: [http://www.mbr-pwrc.
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Catalogue number CW69-4/35-2003E
ISBN 0-662-34260-7
Text: R. Charles Long
Revision: B. Desrochers, 1988; Patrick
Weatherhead, 2003
Editing: Maureen Kavanagh, 2005
Photos: Robert McCaw; Leslie McKim,
Cornell Lab of Ornithology



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well as nationally significant wildlife habitat. Other responsibilities

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are species at risk, control of international trade in endangered spe-
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HINTERLAND WHO'S WHO

BATS



Photo: M. B. Fenton

Bats in Canada

- have wings made of folds of skin stretched between elongated finger bones and the body
- have excellent eyesight
- locate their prey using echolocation, sending out sound waves to find objects in their path
- for their size have exceptional life spans, with some adults living over 30 years

Description

Nineteen species of bats have been recorded in Canada, and 17 of them are regular residents. In many ways, bats are typical mammals: they are warm-blooded, give birth to live young and suckle them. Their ability to fly sets them apart from all other mammals. Their wings are folds of skin supported by elongated finger, hand, and arm bones. Wing membranes attach to the sides of the body and the hind legs. In Canadian species, the tail is enclosed in the membranes. Resting bats usually hang head downward so that taking flight means just letting go.

With their wings spread, flying bats appear larger than resting ones. But bats are small mammals. For example, an average-sized Canadian bat, the little brown bat *Myotis lucifugus*, weighs

about 8 g in summer (the mass of two nickels and a dime) and has a wingspan of about 22 cm. The hoary bat *Lasiurus cinereus* is the largest Canadian species, weighing about 30 g, with a wing span of 40 cm. At about 5 g, the smallest Canadian species are the eastern and western small-footed bats (*Myotis leibii* and *Myotis ciliolabrum*, respectively).

Bats are long-lived mammals, the current record for North America being a banded little brown bat from a mine in eastern Ontario that survived more than 35 years.

Signs and sounds

Bats are well known for their echolocation behaviour. Most bats—and all Canadian species—use echoes of the sounds they produce to locate objects in their path. Higher frequency sounds have shorter wavelengths and give bats more

detailed information about their targets. Most Canadian bat species use echolocation calls that are ultrasonic (beyond the range of human hearing). A notable exception is the spotted bat *Euderma maculatum*, which occurs in the Okanagan Valley of British Columbia and uses lower-frequency echolocation calls readily audible to most people.

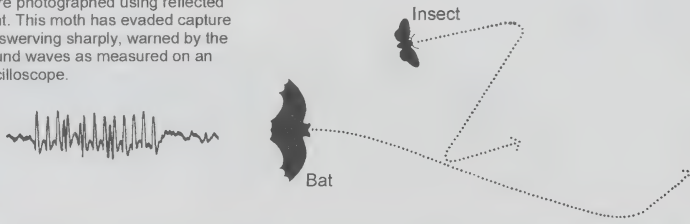
Habitat and habits

Bats are primarily nocturnal creatures, sleeping during the day and hunting and feeding at night.

Bats are not blind. The eyes of many bats that eat insects are inconspicuous, but bats see very well and use vision for many of the things they do. However, as far as we know, Canadian species use echolocation to locate their prey, and their large ears reflect the importance of sounds in their lives. In echolocation, the difference between the original sound and its echo contains the information used by the bat to locate and identify objects in its path. Echolocation is not a characteristic of all bats, and it also is used by toothed whales, some cave-dwelling birds, and mammals such as shrews.

The ears of many insects, including many species of moths, lacewings, crickets,

The flight path of a bat and an insect were photographed using reflected light. This moth has evaded capture by swerving sharply, warned by the sound waves as measured on an oscilloscope.



An insect's sensitivity to the echolocation call of a bat

mantids, and beetles, are sensitive to the echolocation calls of bats. This sensitivity allows these insects to avoid capture by flying away or taking evasive action (as shown in the illustration). The spotted bat is an interesting exception. Most insects cannot detect its lower-frequency echolocation calls, making these bats much more difficult to detect and evade.

In the summer some bat species gather in colonies, while others live alone. The former include species that roost in buildings, such as the little brown bat, big brown bat *Eptesicus fuscus*, and Yuma bat *Myotis yumanensis*. The latter include foliage species (species that roost in trees or vines), such as red bats *Lasiurus borealis*, and hoary bats. Other species, such as the pallid bat *Antrozous pallidus* and the spotted bat, roost in cracks and crevices in cliffs.

In the fall in Canada, when weather conditions become harsher and the insect food supply disappears, bats resort to some combination of migration and hibernation. Some common species that roost in buildings, including little brown bats and big brown bats, make long or short migrations to hibernation sites—little brown bats travel up to hundreds of kilometres; big brown bats migrate up to tens of kilometres. Bats usually hibernate underground, often in caves or abandoned mines, where the temperatures are stable and above freezing and the humidity is very high. Other species, such as red bats, hoary bats, and silver-haired bats *Lasionycteris noctivagans*, migrate to more southern locations, where they may hibernate in hollow trees or leaf litter (red bats) or they may remain active.

Like all other mammals, bats are susceptible to rabies, a viral disease that causes progressive paralysis and death. The rabies virus often is found in saliva and can be transmitted by the bites of infected animals. The incidence of rabies in bats in Canada seems to be low, but we lack details about the general incidence of the disease in the bat population. Some species are more often found rabid than others, and there is geographic variation in the incidence of rabid bats. Nobody should ignore a bite from a bat. Anyone who has been bitten by a bat or other mammal should contact a physician and Agriculture and Agri-Food Canada personnel, who can arrange to have the animal that delivered the bite tested for rabies. Even though Canadian bats are small and their bites make small wounds, they can spread rabies. People working with bats typically have pre-exposure vaccinations for rabies to protect them from this disease.

Unique characteristics

Bats differ from all other mammals in their ability to fly. Their wings are folds of skin stretched between elongated finger bones, the sides of the body, the hind limbs, and, in Canadian species, the tail.

Range

The map shows the distribution in North America of the little brown bat, one of the most common bats in Canada. The summer distribution of the red, hoary, and silver-haired bats is generally similar but probably not as extensive. We must remember, though, that red bats have been found as far north as Southampton Island in the Arctic, and hoary bats also

occur in Hawaii and in the Galapagos Islands in Ecuador.

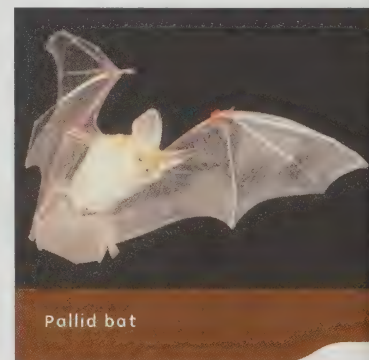
Feeding

Although some bats in the tropics feed on fish, fruit, nectar, or even blood, bats in Canada feed on insects, usually those they catch in flight. Bats eat a variety of insects, including moths, beetles, mayflies, caddis flies, and midges. Insectivorous, or insect-eating, species of bats typically consume 50 to over 100 percent of their body weight in insects each night in summer. This is the same as a 60-kg person eating 30 to 60 kg of food in one day. Although one scientist found 145 mosquitoes in the stomach of one little brown bat, Canadian bats probably eat relatively few mosquitoes, preferring larger insects with more calories.

Birds that pursue flying insects often catch their prey in their mouths, but most insectivorous bats scoop up their victims in wing or tail membranes before transferring them to the mouth. Little brown bats can chew their food very rapidly and in the laboratory have been observed catching fruit flies at a rate of 10 per minute.

Breeding

Early in August, adult males make nightly visits to the caves and mines that will serve as hibernation sites. They arrive at these locations after feeding and spend several hours underground. As August progresses, more and more adult females and young join the males at hibernation sites, and by the middle of August the first matings take place. Most of the mating occurs before the population of hibernating bats builds up in September.



Pallid bat



Distribution of the little brown bat

The females store sperm in the uterus over the winter; ovulation and fertilization occur when the females leave hibernation in the spring. Pregnant females of most Canadian bat species (e.g., little brown bats or big brown bats) gather in the warmest available roosts located in buildings or hollow trees in April or May. Several hundred little brown bats may inhabit one colony. These nursery roosts are the sites where young are born 50 or 60 days after fertilization, in the middle of June, and the young are raised there.

Each female little brown bat gives birth to a single baby. Females leave their babies in the roost each night when they go out to forage. On their returns, mothers unerringly select their own baby from the many others waiting in the nursery. Baby little brown bats grow rapidly, increasing their wing area by 10 times in three weeks and starting to fly

by the age of 18 days. At this stage, they have shed their milk teeth and begun to eat insects as well as their mothers' milk. The months of July and August are spent in heavy feeding as the females and young build up their fat reserves for hibernation.

We know relatively little about the lives of adult males in summer. They do not live in the nursery colonies with females and babies, and we presume they roost alone or in small groups in cracks and crevices.

Conservation

A lack of information about the sizes of most bat populations in Canada makes it difficult for biologists to accurately assess their conservation status. Historical records, for the numbers of bats hibernating in some caves and mines, for example, suggest declines in popula-

tions, but the accuracy of these data is open to question.

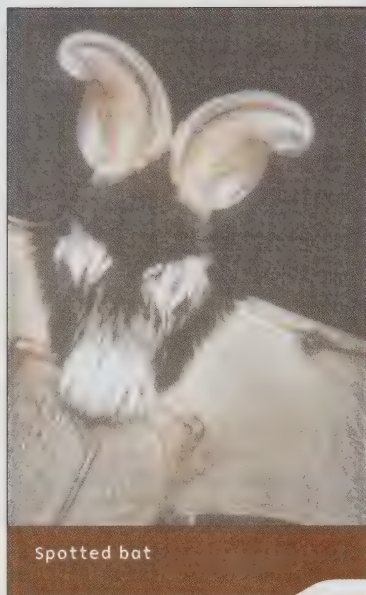
While many animals (including martens, skunks, raccoons, some snakes, domestic cats, and some owls and raptors) are opportunistic predators of bats, there are no records of any predators specializing in bats. Bats appear to be most vulnerable to predators when large numbers are in a roost, arriving at or departing from it.

Disturbance by people is probably one of the main threats to the survival of bats. Disturbances in nursery colonies often result in abandoned young which do not survive the experience. Disturbance during hibernation rouses bats, which in turn forces them to burn energy they otherwise would use in hibernation. One disturbance of this sort costs a little brown bat the energy that would sustain it over 60 days of hibernation. Effective conservation means protecting bat roosts from people.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has determined that for some species in Canada—the fringed bat *Myotis thysanodes* and the Keen's long-eared bat *Myotis keenii*—we lack enough information to make informed judgements about their conservation status; they are designated “data deficient.”

Two other species, the pallid bat and the spotted bat, are considered at risk because of their small populations in Canada that are limited to relatively small areas in southern British Columbia. Pallid bats have been assessed as threatened by COSEWIC and are listed under the Species at Risk Act. This means that it is believed that they are likely to become endangered if nothing is done to reverse the factors leading to their disappearance from Canada. Pallid bats take much of their prey from the ground. They occur only in the very southern Okanagan Valley, where they roost in cliff faces and rock crevices.

Spotted bats are more widespread than pallid bats, but they were only noticed in Canada in 1979. These bats are considered a species of special concern by COSEWIC, and they are under consideration for listing under the Species at Risk Act. (A species of special



Spotted bat

concern is one that may become threatened or endangered because of a combination of biological characteristics and identified threats.) Like pallid bats, spotted bats roost in cliff faces but hunt flying insects, usually in Ponderosa Pine woodlands. They are conspicuous because their echolocation calls are readily audible to people. Survey data suggest that there are not many more than 100 adult spotted bats in Canada. Pallid bats and spotted bats may migrate to the United States for the winter.

Resources

Online resources

Environment Canada – Species at Risk:
www.speciesatrisk.gc.ca

Species at Risk Act Public Registry:
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Catalogue number CW69-4/12-2005E
ISBN 0-662-39656-1

Text: M. B. Fenton, 1987; revised, 2005
Photos: M. B. Fenton

Page 1 photo: Little brown bat



The Canadian Wildlife Service

The Canadian Wildlife Service of Environment Canada handles wildlife matters that are the responsibility of the Canadian government. These include protection and management of migratory birds as well as nationally significant wildlife habitat. Other responsibilities

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HINTERLAND WHO'S WHO

BEAVER



This animal

- is the largest rodent in North America
- is a superb engineer: it builds impressive dams, canals, and lodges
- can see as well underwater as on land
- is ungainly and slow on land, but is graceful and strong in water
- has influenced the history of Canada more than any other animal

Description

The beaver *Castor canadensis* is the largest rodent in North America and the largest rodent in the world except for the capybara of South America. An adult weighs from 16 to 32 kg and, including its 30-cm tail, a large beaver may measure 1.3 m long. Its ancestors were even larger. In the Pleistocene ice age—the era of the mastodons and the mammoths—the giant beavers that inhabited the expanses of Eurasia and North America measured just under 3 m in length, including the tail, and probably weighed 360 kg.

Very compact and rotund, the beaver is ungainly and slow on land. Not so in the water. The beaver is a graceful, strong swimmer, both under water and on the surface, attaining speeds approaching 7 km per hour if it is alarmed.

The beaver's body is adapted in many ways to the animal's watery habitat. The

beaver's eyes see as well in the water as out of it thanks to a specialized transparent membrane that can be drawn over the eyes for protection while diving. The nostrils are small and can be closed for underwater swimming, as can the ears.

The beaver's tail has important uses both in the water and on land. The tail of a large beaver may be 30 cm long, up to 18 cm wide, and 4 cm thick. It is covered with leathery scales and sparse, coarse hairs. Although fat, the tail is flexible and muscular. In the water, the animal can use its tail as a four-way rudder. On land, the tail acts as a prop when the beaver is sitting or standing upright. It also serves as a counterbalance and support when the animal is walking on its hind legs while carrying building materials like mud, stones, or branches with its front paws.

The beaver's hind feet are very large, with five long blunt-clawed toes which are fully webbed, for swimming. In the water, the

beaver holds its forepaws close to its body, using only its hind feet to propel itself, with occasional aid from its tail. Its forepaws are small, without webs, and the toes end in long sharp claws suited to digging. These delicate paws are very dextrous—almost like hands—and with them the beaver can hold and carry sticks, stones, and mud and perform a variety of complex construction tasks.

The beaver also uses its paws to groom its coat. The second toe on each hind foot is double-clawed, the claws being hinged to come together like tiny pliers. These specialized claws, along with the front claws, are used for combing the fur, which is brown in colour. The beaver has several reasons to groom itself. Its fur is very dense, consisting of a mat of fine underfur about 2 cm long and an outer layer of heavy guard hairs about 7 cm long. Through constant preening and oiling, this dense pelt is kept water-proof: even after swimming under water for six or seven minutes the beaver is not wet to the skin. Oil is obtained from two glands near the anus and, like preening, application of oil is done with both front and hind feet. Preening also removes dirt, straightens matted fur and removes mites and other insect parasites. Members of family groups spend considerable time preening each other. The beaver moults in spring and in late autumn.

Finally, the animal has exceptional teeth. Its long, sharp, strong incisors grow continuously and are hardened with a dark orange enamel on the forward face. Consequently, as the upper and lower incisors are ground against each other, the outer tips of these teeth are maintained chisel-sharp. With them, a beaver is able to fell very large trees. The lips can be closed behind the incisors, permitting the beaver to gnaw on twigs while under water.

Beavers may live as long as 12 years.

Signs and sounds

Beavers have a system of communication that includes physical markers and noises. They often leave “mud pies” on their trails, on which they leave paw prints and the oily deposit of a musky oil that they secrete. (See the illustration of their tracks, below.) They also communicate through low whines and bellows and the pistol-shot-like slap of the tail on water, which warns other beavers that danger is near.

Habitat and habits

Most common in forested areas, beavers also expand into unforested habitats, where there are water-courses bordered by deciduous trees or shrubs.

Each day, beavers alternate periods of activity and rest. They are most active from dusk to dawn. Midday generally finds them in the lodge, be it summer or winter.

Unique characteristics

The beaver's life is inextricably connected to logging—for sustenance and for habitation. This animal cuts down an average of

216 trees a year. It can fell trees up to about 40 cm in diameter. Usually a single beaver cuts a tree, but sometimes two work on a large one.

The beaver is a wonderful builder, and what it builds depends on where it lives. Its best-known structure, the dam, is only built by beavers that need to enlarge the underwater habitat that will be open to them in winter. The dam creates a pond deep enough not to freeze to the bottom, providing storage for winter food and year-round underwater access to the lodge secure from predators.

The beaver begins the dam by laying sticks and rocks in the stream bed at a narrow point in the river where the current is fastest. It embeds some sticks so that the butt ends face upstream, allowing the current to spread the branches more securely on the bottom and pack the stones, roots, and mud that complete the dam into the spaces between the twigs and leaves. Layer upon layer is added, and the result is a very stable earthwork that can withstand great water pressure and erosion. Dams as high as 5.5 m have been discovered.

Dams are maintained throughout the year, but the beavers add most material during periods of high water. Breaks in dams are infrequent, probably because of daily inspection and maintenance.

The beaver also builds a lodge, which may be occupied for many years. Located in the middle of a pond or on the bank of a waterway, this structure is usually built in one month in the autumn. The lodge includes a feeding den, a resting den, a source of fresh air, and usually two underwater entrance tunnels, which allow for a means of escape if a predator enters the lodge through one of the tunnels. The dens are constructed on a platform 10 cm above the water line so that they will remain dry. The beavers create them by gnawing out space in the pile of mud, twigs, and bark that constitute the lodge.

The size of the lodge depends on the size of the family group, number of years of occupation, and fluctuating water levels. Most lodges are about 5 m in diameter and about 2 m high. As freezing weather begins, the beavers, using their front paws, plaster the lodge with mud, except about the air intake near the top, making

a concrete-like outer shell which no wolf, wolverine, or lynx can break through.

Another impressive feat of beavers is the building of canals. Canals may extend several hundred metres along the base of a wooded hillside. Often 1.5 m wide and 1 m deep, they provide easy transportation for food supplies. Sometimes canals are dammed to maintain the water level on uneven ground, and occasionally nearby streams are diverted into canals to maintain the water level.

Range

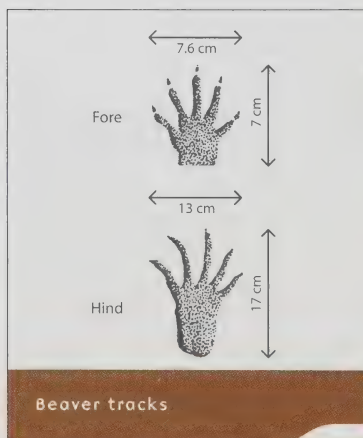
Beavers are found throughout Canada, north to the mouths of the Mackenzie and Coppermine rivers on the Arctic Ocean. In the rest of North America, the beaver's range extends throughout southwestern Alaska and most of the states south of the 49th parallel. The beaver has been exterminated in some states, and in practically all of its former range in northern Mexico.

Feeding

Every fall, beavers in northern latitudes construct food caches, or piles, in deep water close to the lodge or bank den they have constructed. Each cache is an accumulation of the beavers' favourite woody food items, and it is meant to sustain the beavers in the winter. With the first frosts of September and October, the animals begin to prepare the cache by clearing trees away from the edge of the water. If the area is relatively free of predators, the beavers take their logging operation farther afield—often 125 m away. They gnaw the trees into short lengths and tote them to the water, along trails that they have cleared, for underwater storage.

The bulk of the edible forage, or food, in the cache is held below the water surface by a thick top layer of small, leafy branches most often cut from trees and shrubs that are not the beavers' most preferred. The top layer protrudes well above the water surface, where it intercepts snow to provide an insulating cover that prevents water from freezing in and around the stored food. (See the illustration of a beaver lodge, back page.)

All winter the beavers bring sticks from their underwater cache into the feeding chamber of the lodge to gnaw the succulent bark. They prefer trembling





Distribution of the beaver

aspen, poplar, willow, and birch; half a hectare of aspen will support one beaver for a year. They also swim out under the ice and retrieve the thick roots and stems of aquatic plants, such as pond lilies and cattails. During mild winters and warm days in March and early April, adult beavers emerge from their dull aquatic world to feed on fresh woody stems along the shore. On such forays they often fall prey to hungry wolves.

Beavers shift from a woody diet to a herbaceous diet as new growth appears in the spring. During summer, beavers will eat grasses, herbs, leaves of woody plants, fruits, and aquatic plants.

Breeding

A beaver takes only one mate, which it keeps for life. The family is the basic unit of the beaver's society, and the female is the central figure. The female usually establishes the home site, and if her mate is lost, she remains with her family, and another male joins her in the mating season. If the female is killed and leaves no female offspring, the male usually abandons the site.

Mating occurs in January and February. Shortly before the kits are born, the female drives the male from the lodge the beavers have built, and he moves temporarily into an old lodge or a burrow in the riverbank. One litter, averaging three or four kits, is born each year in May or June following a 100-day gestation period. The young measure about 125 mm long and weigh about 450 g. Although they are well-furred, have teeth already cut, and can see, walk, and swim when born, the kits generally don't move out of the lodge for at least one month. If the kits are threatened, the female will usually carry them in her mouth, under water, to another retreat. The young stay with their parents until they are two and sometimes three years old. They do not work the first summer, but the second season they help with many colony chores, including cutting food, repairing the dam and lodge, and digging channels and canals.

The kits disperse the following spring in response to an innate urge to leave the home colony, and migrate along streams or across country until they find mates and suitable building sites, whereupon they establish their own dams and lodge.

These dispersal migrations can vary from just a few kilometres to 250 km.

Conservation

Although their aquatic habits offer excellent protection from predators, beavers are vulnerable in many ways. Beavers fall prey to wolves, coyotes, bears, lynx, and wolverines when foraging on shore or migrating overland. The river otter is able to enter the den via the water and kill the kits inside; however, an adult or subadult beaver always stays with the kits to offer protection. Sudden fluctuations in water levels can force beavers to leave their den and face danger on shore.

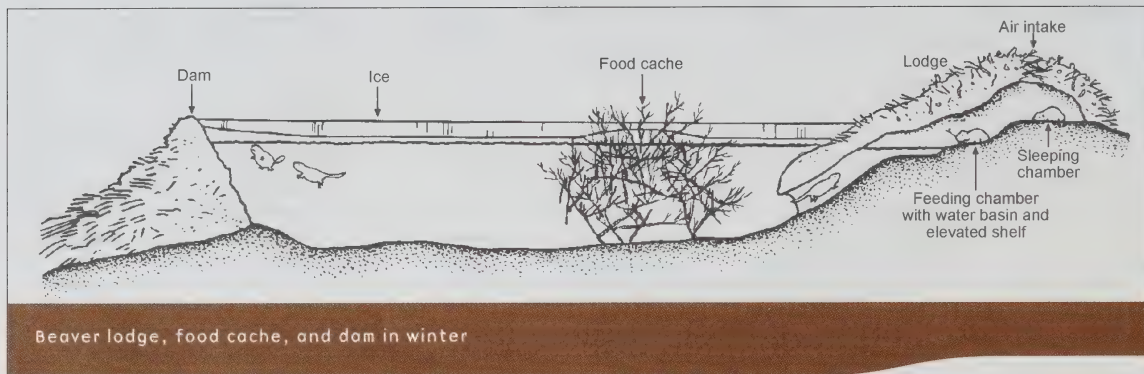
At bay, beavers stand their ground and protect themselves. They face the aggressor, rear up on their hind legs, and loudly hiss or growl before lunging forward to deliver extremely damaging bites.

During the peak of the fur trade era, some 200 000 pelts a year were sold to the European market, most being used to make the then-popular beaver hats. A large adult beaver skin yielded enough fur for 18 hats.

About 100 years ago, the trade in beaver waned, partly with the decline of the beaver hat as fashionable headgear, and partly because the beavers themselves were becoming scarce all over North America. Many large regions were completely without beaver during most of the first half of the 20th century.

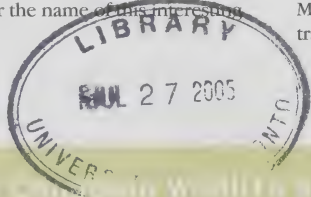
The beaver conservation movement began in the late 1930s with the writings and lectures of Grey Owl. A native of England who posed as a Métis, Grey Owl created passionate stories of the plight of the Canadian forests and wildlife, and particularly the beaver. Governments responded by closing the beaver trapping seasons for many years.

More recently, conservation plans have been put into effect by federal and provincial governments, with the co-operation of trappers, and beavers have been reintroduced into many areas that were stripped by early trappers. As a result, there has been a tremendous increase in the number of beavers in Canada, and their population is now a healthy one.



In some areas the problem is not how to protect the beaver population, but how to prevent damage to farmlands, roads, and tree plantations from beavers' damming and cutting practices. A combination of trapping and use of flood control devices is necessary. Beavers maintain water levels, improve habitat for many forms of wildlife, stabilize stream flow, and prevent stream bed erosion, so it is important that they be managed carefully.

No other animal has influenced Canada's history to the extent that the beaver has. When Europeans began to settle in northern North America, beaver pelts were the prize that lured them farther and farther into the wilderness. Canadians now celebrate the beaver as a national symbol on stamps, coins, and emblems; in addition, literally hundreds of Canadian lakes, towns, rivers, and hill ranges bear the name of this interesting rodent.



Resources

Online resources

Northeast Furbearer Resource Technical Committee: www.anr.state.vt.us/furbearer/animals/beaver.html

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Catalogue number CW69-4/2-2003E
ISBN 0-662-34264-X

Revision: Garry Trotter, 1989, 2003

Editing: Maureen Kavanagh, 2005

Photo: Tom W. Hall

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are species at risk, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

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BICKNELL'S THRUSH



Photo: Dan Bentley

This thrush

- was recognized as a distinct species only in 1995
- is relatively rare; there may be as few as 4,000 in Canada
- is the only bird that breeds exclusively in northeastern North America
- keeps a nest tended by up to four males
- is one of the least-known birds in North America

Description

Bicknell's Thrush *Catbarus bicknelli* was discovered in 1881 by Eugene Bicknell in New York's Catskill Mountains, but it was only named a distinct species in 1995. Before then, it was thought to be a subspecies of the Gray-cheeked Thrush *Catbarus minimus*, which it closely resembles. It was a Canadian ornithologist, Henri Ouellet, who convinced authorities that the Bicknell's and the Gray-cheeked thrushes are distinct species. Because this thrush favours habitats that are difficult for humans to explore and because it is relatively rare, it remains one of the least-known birds in North America.

Bicknell's Thrush is a small, sparrow-sized bird. The male and the female are identical except that the male is slightly larger. Measuring 16 to 18 cm long and weighing 25 to 30 g, Bicknell's Thrush is one of the

smallest of the *Catbarus* thrushes. A pale yellow colour extends from the bird's face halfway or more along its lower mandible. At a distance, the bird appears to be mainly a drab, olive brown. Close up, however, the plumage is more attractive, with a warmish brown cast to the back and a chestnut brown tint on the upper tail feathers. This thrush has a striking buff-coloured chest with dark spots decorating the chin, breast, and sides. Its legs are purplish-brown, and the soles of its feet are pale yellow. Its large eyes are an adaptation for seeing in the darkness of its dense habitat.

One must be cautious when identifying this bird in the field. It looks like several other thrushes, chief among them the Gray-cheeked Thrush. This relative is somewhat larger, has a more uniformly olive-grey back, less pale yellow on the lower mandible, and a slightly different song. Fortunately, the ranges of these two species do not overlap, except during the

migration period, making it easier to distinguish one from the other.

The Hermit Thrush *Catbarus guttatus* has a more distinct chestnut colour on the upper tail than Bicknell's Thrush, as well as more blackish spotting on the breast. The Swainson's Thrush *Catbarus ustulatus* has a fairly obvious buff eye ring, and its upper tail feathers show no chestnut coloration. The Veery Thrush *Catbarus fuscescens* has a rich reddish-brown on its back and tail and brownish spotting on the chest.

Signs and sounds

Like the other *Catbarus* thrushes, Bicknell's Thrush sings with a spiralling, flute-like whistle. Perhaps not as beautiful as the Hermit's or as prolific as the Swainson's, the Bicknell's song is nevertheless a sound like no other. Sung mainly by the male, the song has been described as a *chook-chook, wee-o, wee-o, wee-o-ti-teree*. Although there is considerable variation among regions and individuals, the downward-spiralling song almost always ends with a strong, rising inflection. Several different call notes have been observed and recorded and have been described as *beer, veer, beeeaa* and *queep*. Under stress, Bicknell's Thrush may also "mute" or whisper its song, sounding like it is much farther away than it is.

Habitat and habits

Bicknell's Thrush breeds in two types of habitats: those undisturbed by humans and those transformed by commercial forestry activities. In the former, Bicknell's Thrushes make their home in mountainous forests of fir and spruce. They favour areas where there is vigorous new growth and exposed mountains and plateaus where the trees are stunted, windblown, and often shrouded in fog. These habitats usually contain dead standing trees or "snags."

While the birds gravitate towards the mountaintops, it is not the elevation in itself that draws them there; in addition to suitable vegetation, it's the cool, damp climate. Scientists believe this because the birds also frequent lower habitats off the shores of Cape Breton Island on St. Paul and Scaterie islands, as well as other low-lying coastal localities with climates and forests similar to the birds' mountaintop habitats.

Scientists observed the birds' acceptance of industrial forest habitats, where trees are at various stages of growth, relatively recently. The birds can be found scattered throughout highland industrial forests, where they prefer very dense, regenerating spruce and fir between 2 and 8 m high. Because these habitats are rapidly growing and changing, they may be suitable as Bicknell's Thrush habitat for only five or 10 years.

On the wintering grounds in the Greater Antilles, Bicknell's Thrushes live mainly in broadleaf mountain forests and mostly in habitats above 1 000 m.

Reproduction and Mating

Bicknell's Thrushes have an unusual mating system in which females mate with more than one male. Such a mating practice is not known to occur in other thrushes. As many as four males perform duties connected with one nest, including bringing food for the nestlings.

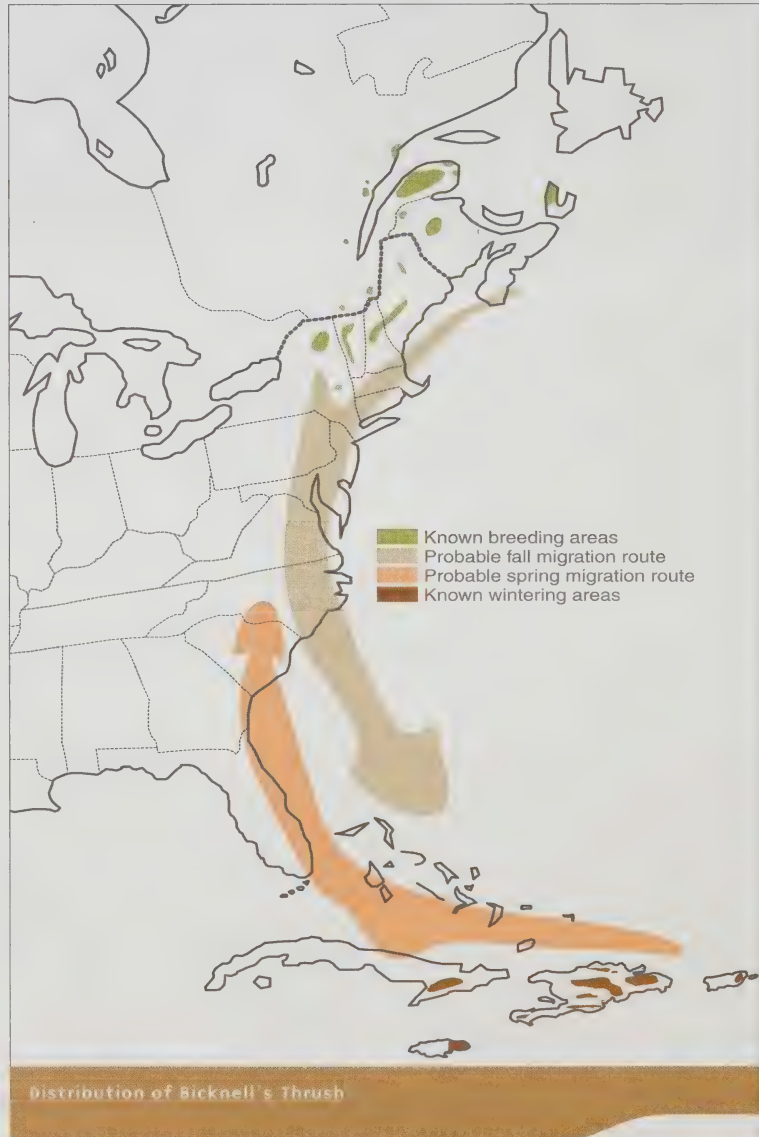
Range

The entire breeding population of Bicknell's Thrush is restricted to northeastern North America, a claim that can be made for no other living bird

species. The range is small, bounded by New York to the south and Cape Breton and southeastern Quebec to the north. Except for a few offshore islands and coastal sites, Bicknell's Thrush occupies mostly the highest elevations in the Cape Breton Highlands, north central and northwestern New Brunswick, the Gaspé Peninsula highlands, the Mégantic and Gosford mountains in the extreme southeastern corner of Quebec, the Laurentian Wildlife Reserve region and a

few other scattered localities on the north shore of the St. Lawrence River, and on Monts Valin north of the Saguenay River. In the United States, this thrush is found mainly in the Catskill Mountains of New York, the Green Mountains of Vermont, the White Mountains of New Hampshire, and the mountains of western and central Maine.

The wintering range is even more restricted. Known populations are located



mainly in the Dominican Republic and Cuba, with smaller numbers in Jamaica, Puerto Rico, and Haiti.

Feeding

Bicknell's Thrush feeds mainly on beetles, ants, caterpillars, and spiders. A bird that primarily finds its food on the ground, this thrush also catches flies and gleans insects from the foliage of trees. It adds wild fruit to its diet in late summer, during migration, and on the wintering grounds.

Breeding

It appears that adult Bicknell's Thrushes return year after year to the same area to breed. Scientists believe that younger birds, however, return to the same general region but not the same specific area. Breeding home range size varies considerably, and may be as little as 4 ha or as much as 80 ha, depending on local circumstances. Home ranges that are beside each other usually overlap.

Bicknell's Thrushes breed when they are one year old. The males arrive at the breeding grounds in mid-to-late May, usually a few days before the females. Shortly after reaching the breeding grounds, the male heralds the mating season by singing throughout the day to signal his availability to arriving females.

Soon after mating begins, a nest site is selected, probably by the female. The birds begin building the nest in early to mid-June. It is bulky, cup-shaped, about 12 cm across, and is built primarily from twigs and moss and lined with materials such as thread-like fungus, grasses, dry leaves, bark strips, animal hair, and lichen. The nest is usually located in a dense stand of young spruce or fir, at the base of horizontal branches against the trunks of the small trees. The birds normally take a week to 10 days to build the nest, but, if necessary because of destruction by a predator or accident, the nest can be rebuilt in as few as two days.

The female lays one egg a day, usually in the early morning hours. The eggs are generally bluish-green with light brown speckles, and the size of the clutch, or set of eggs, is three or four. A second brood is

rare, but a replacement clutch is normal if the first is lost early in the season. The female begins incubating, or warming, the eggs, after she lays the second-last egg. Incubation is done entirely by the female.

The young hatch after about 12 days. They are without feathers and are completely dependent on the adults for food and warmth. As with most songbirds, Bicknell's Thrush nestlings grow rapidly, developing in 12 days from peanut-sized hatchlings to completely feathered adult-sized birds. Young fledged birds remain in the general area of the nest while the adults continue to care for them. By the fall migration in September, they are independent. On average, each nest produces only one or two fledglings, and in years when the species' main predator, the red squirrel, is abundant, even fewer young birds survive.

Conservation

Information on the number of Bicknell's Thrushes is very poor. There are several reasons for this. First, most estimates are based on classic models of territoriality, where each singing male is counted as a pair. However, since the mating system of Bicknell's Thrush involves up to four males at each nest, this method may not produce accurate numbers. Second, because males do not defend territories, their home ranges in a given sector often overlap, complicating efforts to estimate the number of birds in an area. Finally, Bicknell's Thrushes are not evenly distributed within their habitat. Based on the limited knowledge about the birds, scientists calculate the total number of Bicknell's Thrushes at well below 50 000. In Canada, 4 000 to 15 000 birds is a realistic estimate, with the birds fairly evenly split between the Maritimes and southeastern Quebec.

Habitat degradation is posing a considerable threat to the breeding habitats of Bicknell's Thrush. Scientists believe that industrial pollution is one of the main reasons for the decline of the red spruce, an important element in Bicknell's Thrush habitat in the United States. They also think that airborne heavy metals have damaged high-elevation forests in the northeastern United States. Furthermore, based on expected substantial carbon dioxide increases by the end of the

century, scientists predict a radical reduction of balsam fir forest in the eastern United States.

Other known potential threats to Bicknell's Thrush habitat are the development of recreational skiing and summer sports areas, increasing numbers of telecommunications towers on mountaintops, cyclical spruce budworm outbreaks, and commercial forestry operations. If they are modified, industrial forestry practices, although possibly harmful, may aid in conservation efforts to protect Bicknell's Thrush. While much more study is needed, the bird's apparent acceptance of certain commercial second-growth forest gives promise to possibilities of "growing" Bicknell's Thrush habitats in the future.

There is also considerable concern about the degradation of Bicknell's Thrush's wintering habitats. The Dominican Republic's native forests are under considerable pressure from naturally occurring events such as hurricanes, as well as changes for agricultural activities, particularly at low altitudes. The forested lands of Haiti have been almost completely eliminated. In Cuba, most of the known suitable habitat exists in protected parklands.

Predators include the Sharp-shinned Hawk, the long-tailed weasel, and the Northern Saw-whet Owl. Perhaps the most important predator, however, is the red squirrel, the main confirmed predator of eggs and nestlings in breeding ecology studies. In years when red squirrel populations are high, the reproductive success of Bicknell's Thrush declines. Fragmented habitat caused by commercial development is thought to allow the red squirrel to infiltrate the breeding sites of Bicknell's Thrushes.

Bicknell's Thrush is listed by the Committee on the Status of Endangered Wildlife in Canada and the Province of Nova Scotia as a Species of Special Concern, meaning that it has characteristics that make it particularly sensitive to human activities or natural events. In the United States, Bicknell's Thrush has been cited as a top priority bird species for conservation concern in the northeastern United States Partners in Flight initiative, a program coordinated by

government and nongovernment groups to conserve landbirds.

Much remains to be discovered about this mysterious bird. Its recent designation as a species, its affinity for remote and inhospitable habitats, and its relative rarity are factors that help explain why our store of knowledge is still limited. Almost nothing is known about the size of the population over the years or possible recent declines. What is known is that Bicknell's Thrush is no longer found in some areas where it was once common. Research and population monitoring are needed before comprehensive management and conservation plans can be implemented.

Resources

Online resources

Environment Canada—Atlantic region:
[www.atl.ec.gc.ca/wildlife/
bicknells_thrush](http://www.atl.ec.gc.ca/wildlife/bicknells_thrush)

Environment Canada—Species at Risk:
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Catalogue number CW69-4/103-2004E
ISBN 0-662-34266-6
Text: Dan Busby, Yves Aubry
Editing: Maureen Kavanagh
Photo: Dan Busby

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BIRD FEEDING



- Setting up a bird feeder is an excellent way to start studying birds.
- Sunflower seeds are among the most versatile food for birds.
- Where you live, the type of food you offer, and the habits of different bird species will determine the types of birds you will attract to your feeder.
- There are ways to prevent squirrels, cats, and dogs from harming birds or their food at feeders.
- It is best not to feed ducks and geese.

A hopper-type feeder that can hold food for several days can help ensure a continuous supply. Many good feeders can be made at home. A plastic bleach bottle can be cut to provide a large opening in one side and then hung from a branch by its handle. Half a coconut, pine cones, or a piece of bark can be used to hold a suet mixture. Suet can be hung from a tree in a plastic mesh onion bag. A Christmas string of popcorn and cranberries draped on a tree is a festive offering for the birds. Just be sure that feeders have no exposed metal parts in areas where the weather gets very cold. Commercially built feeders can also be an excellent value.

Types of feeders

The best way for most Canadians to start a study of birds is to establish a bird feeder, and the best time to feed birds is in the winter, when there are fewer species present and when many birds can be attracted to the bird feeder for observation. Watching the feeding birds can help people recognize the different species and learn about the birds' habits of migration, nesting, and feeding.

Feeding birds can be a very simple affair. Just scattering bread crusts on the snow or seed on a bench or table will attract some birds. But if bird feeding is to be a long-term interest, some additional steps should be taken to avoid problems.

- The food must be protected from rain and snow or from unwanted guests such as squirrels.
- It is best to place food in a feeder which protects seed from bird droppings.
- The birds should not be made vulnerable to predation or other hazards by careless placement of the bird feeder.
- It is important to continue feeding through bad weather so that any birds that may have become dependent on the food supply will be able to eat when they need to. This is most important just after winter storms. (Of course, if your neighbours are also putting out bird food, the birds are less dependent on any one feeder).

What to feed

Try a few foods and use what works. Sunflower seeds are among the most versatile food for birds. Two kinds of sunflower seeds are used, a larger striped kind and a smaller black kind; the black kind is popular with more species of birds. Sunflower seeds may be used without any other food, if desired.

Commercial bird seed mixtures sometimes contain seeds that are of little interest to most birds. Millet is good, but a study by the United States Fish and Wildlife Service showed that, in one region at least, white proso millet was

generally preferred to yellow or red millet. Many species like cracked corn, but the corn is likely to spoil if wet, and it is more attractive to species, like pigeons, that are often considered pests. Oats, buckwheat, wheat, and rapeseed have limited interest for birds. Niger seed (an imported thistle seed) is excellent for small finches but can be expensive.

Many types of kitchen scraps can be given to birds. Of these, some of the most often used are baked goods (give sparingly and watch for mould) and fats. Larger pieces of fat, especially beef suet, can be used as is or can be rendered by heating to separate the fat from the connective tissue. Melted fat can be mixed with bread crumbs and seeds and packed into dishes or other feeders. Peanut butter is loved by birds, but some people say it should be mixed with fat to reduce any danger of choking.

Most birds appreciate water to drink if the weather is not too cold. Birds also use grit to help their digestion. Provide dirt, sand, or ground eggshells separately from other foods for this purpose. Sometimes a few wood ashes or a dry supply of salt can provide minerals the birds need.

To limit cost, put a measured amount of food out each day, whatever you decide you can afford. If the feeder is empty an hour later, don't worry. If you are consistent, the birds will adjust their foraging to the supply and find more food elsewhere.

The birds

What kind of birds can you expect once you've put out some food? The bird species attracted to a feeder will depend on many factors, including the geographic region you live in, the type of food you offer, the habitat of the immediate area, the habits of individual bird species, and the weather. Habitat is a very important factor in attracting birds: an area with trees and shrubs will be the most likely to appeal to them. It is also important to start feeding early in the fall before the birds become set in their winter foraging patterns.

Table 1 lists many of the species that come to feeders in Canada. These species, most of which are discussed

below, are widespread and can be found in most regions where there are mature trees, even in densely populated urban areas. Table 1 also indicates some of the birds' favourite foods. Do not assume, however, that birds in your area will necessarily exhibit the preferences shown. Experiment, and you may find other useful foods not listed in the table.

Chickadees are some of the most familiar birds that visit feeders. They travel around a small area of a few hectares, stopping in woodlots where they look

for insects and insect eggs and coming to feeders for sunflower seeds and suet. They are adept at opening sunflower seeds by holding them with their feet and striking them with their bills, like little woodpeckers.

Blue Jays are conspicuous visitors with their bright plumage. In the fall, Blue Jays store food, sometimes carrying away many sunflower seeds packed in their cheeks. At that time of year you might like to feed the Blue Jay some whole corn, which is less expensive than

Table 1: Some birds that commonly visit feeders in Canada

Species	Range in Canada	Some foods
American Goldfinch	widespread; milder areas	sunflower seeds, Niger seed
Black-capped Chickadee (Boreal Chickadee in northern areas)	widespread	sunflower seeds
Blue Jay	widespread; replaced by Steller's Jay in far west	sunflower seeds, peanuts, whole corn
Common Redpoll	widespread; numbers increase every two years in some areas	sunflower seeds, Niger seed
Dark-eyed Junco	widespread; milder areas	millet, other small seeds
Evening Grosbeak	widespread	sunflower seeds
Gray Jay	widespread	sunflower and other seeds
Hairy Woodpecker, Downy Woodpecker	widespread	suet, sunflower seeds
House Finch	west; established as an introduced species in the east	sunflower seeds, small seeds
House Sparrow	widespread around settlement	all seeds
Mourning Dove	milder areas	corn, millet, sunflower seeds
Northern Cardinal	east, milder areas	sunflower seeds
Pigeon	widespread around settlement	corn, bread, seeds
Pine Grosbeak	widespread	fruits and seeds on shrubs and trees
Pine Siskin	widespread; numbers increase temporarily in some areas	Niger seed, sunflower seeds
Purple Finch	milder areas	sunflower seeds, small seeds
Red-breasted Nuthatch	widespread	suet, sunflower seeds
Snow Bunting	widespread; visits feeders in open areas	small seeds on ground in open areas
Song Sparrow	milder areas, especially southern British Columbia	millet, ground feeding
Starling	widespread around settlement	suet, bread
Tree Sparrow	milder areas, but more widespread than Song Sparrow	small seeds, ground feeding
White-breasted Nuthatch	widespread; southern	suet, sunflower seeds

sunflower seeds. Blue Jays are much less trusting of people than chickadees are and usually retreat to a distant viewing point when people come to the feeder.

Several species have changed their winter range, thanks to bird feeding. Among these are Evening Grosbeaks, which come in flocks for sunflower seeds. Cardinals have started nesting far north of their historical range, probably because of the winter food provided at feeders.

Some birds are quite unpredictable in their annual visits to bird feeders. Redpolls, Evening Grosbeaks, and Pine Siskins come in variable numbers depending on their natural food supply and on the weather. Others, such as the Hairy Woodpecker and the Black-capped Chickadee, are resident year-round in the feeding area and so can be expected at feeders with some certainty.

The House Finch is of special interest at feeders. It was originally a western species, but in 1941 a few individuals were released in New York City. Since then it has spread and has become common in southern parts of Ontario and Quebec. More recently it declined again, as a result of a disease that may have been spread, in part, through concentration of the species at bird feeders.

Some birds that usually eat dormant insects and their eggs in the winter can be attracted to feeders by fat-rich foods such as suet, and, for some species, sunflower seeds. Nuthatches, woodpeckers, and chickadees are all fat-loving species. Some people do not like pigeons, starlings, or House Sparrows and prefer jays, chickadees, and finches. Offering sunflower seeds alone may help eliminate the first group and attract the second. Fat attracts starlings but is probably worth it if it brings woodpeckers too.

A yard with plantings of bushes such as saskatoon, elderberry, mountain ash, nannyberry, and crabapple or plantings of vines such as wild grape or Virginia creepers will attract birds that eat fruit and are rarely found at regular feeders. Even the American Robin will overwinter where such a food supply is abundant.

Problems

Sometimes problems develop at bird feeders. Perhaps the most common is the presence of squirrels, which can eat a large amount of food and can also damage wooden feeders. It is possible to buy a squirrel-proof bird feeder. You can also make one at home by placing inverted metal funnels on the feeder post below the feeder or by positioning large disks above hanging feeders. Remember that squirrels can jump, especially from above, that they can walk on a tight rope, and that they can get toeholds on any imperfections in whatever you are using to exclude them.

Cats and sometimes dogs can be a worse problem; they may kill the birds or take suet at feeders. If these animals have free range around the feeder, avoid giving them places to hide from which they can pounce on birds. Be sure the feeders are close to natural hiding places for the birds, such as shrubs, but far enough away from them—2 to 3 m—to keep birds safe from cats that may be using the shrubs as cover. Other predators may also visit feeders, but these wild animals have a role in nature, and we should respect their need for food.

Sometimes birds fly into windows and injure themselves. This usually happens when feeders are placed less than 10 m from windows, because at this distance, birds can see vegetation reflected in the windows or through the windows. If a window near a feeder has a number of such bird strikes, try leaving a curtain closed when the birds are feeding. If this does not help, you may have to move the feeder. A bird feeder can usually be safely fastened to a window or placed very close to it, because in this case, if birds are startled while at the feeder, they will be moving too slowly to injure themselves if they hit the window.

Most other problems can be avoided by regular attention to the feeder. Keep the feeder well stocked in bad weather, and do not let wet food stay in the feeder long enough to spoil. Notice which foods are being ignored by the birds, and adapt your feeding plan accordingly.

Many people like to feed waterfowl, including ducks and geese. In fact, it is best not to do so. Water birds that come

to rely on handouts may lose their compulsion to migrate and their fear of people, and they may pick up habits that might harm both the birds and people. When birds are not afraid of cars and planes, for example, they may cause safety problems by walking across roads or flying across airport runways. And the birds' tendency to gather in large groups in confined areas when they expect to be fed increases competition for limited food supplies. When winter arrives, the added stresses of eating less nutritious food than they would consume under normal conditions and exposure to harsh weather make the birds more susceptible to life-threatening diseases. If you just can't help yourself, don't feed the birds before the end of the hunting season in your area. It is illegal to put out food for waterfowl during the hunting season except under permit. Your best food choices are grains like wheat and corn because they keep well outside.



Other activities

A well-established feeder provides a starting point for other activities with birds. Photography of birds at the feeder can provide hours of enjoyment. If you are taking pictures of birds, watch to see how they use branches as stopping places before they fly to the feeder. Set up your camera to focus on one of the branches for more natural pictures than

are possible on the feeder itself. Feeding can be continued through the summer months to attract a different mix of species. You will sometimes be rewarded by local nesting species bringing their young to the feeder. It is interesting to keep records of the birds at your feeder. In Canada, the Long Point Bird Observatory in Port Rowan, Ontario, coordinates Project FeederWatch. In that survey, observers have recorded over 100 different kinds of birds at feeders, and many mammals as well.

Resources

Online resources

Audubon and Cornell Laboratory of Ornithology: www.birdsource.org

Project FeederWatch:
www.bsc-eoc.org/national/pfw.html

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Catalogue number CW69-4/21-2003E
ISBN 0-662-34268-2

Text: Steve Wendt

Revision: Steve Wendt, 1993; Steve Wendt, Erica Dunn, and Becky Whittam, 2003

Editing: Maureen Kavanagh, 2005

Photos: Gerry Beyersbergen



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BLACK-CAPPED CHICKADEE



Photo: Daniel Mennill

Characteristics

- Black-capped Chickadee (Parus atricapillus) is a small, stocky bird with a black cap and a white cheek patch. It is found in the eastern United States and southeastern Canada.
- The Black-capped Chickadee is a member of the Paridae family, which includes other small, active birds like titmice and nuthatches.
- It is a very hardy bird, capable of surviving in cold climates. It is also a very social bird, often found in small flocks.
- The Black-capped Chickadee is a very vocal bird, with a variety of calls and songs. Its most famous call is the "chickadee-dee-dee" song.
- It is a very intelligent bird, capable of solving complex problems. It is also a very curious bird, often peering over its shoulder to see what is behind it.
- The Black-capped Chickadee is a very hardy bird, capable of surviving in cold climates. It is also a very social bird, often found in small flocks.

often dusky white and the throat patch is black. Like the Black-capped, it lives right across Canada, but resides in the belt of coniferous forest that extends to the northern treeline. Boreal and Black-capped Chickadees overlap at the edges of their breeding ranges, but do not hybridize.

The Chestnut-backed Chickadee *Poecile rufescens* lives in the coastal forest and southern part of British Columbia. Its brown crown and brownish-black throat match well with its chestnut back and sides.

Description

Measuring only 12 to 15 cm from bill-tip to tail-tip, the Black-capped Chickadee *Poecile atricapilla* is greenish-grey above with a white underside shading to light brownish buff along its flanks. Its long, dark-grey tail looks like a handle. A black cap, well drawn over sparkling eyes, covers its head from cone-like bill to nape, or back of the neck. Pure white cheek patches and a triangular black throat patch complete its most conspicuous markings. Because chickadees inhabit such a wide variety of climates and habitats, birds from different populations may vary somewhat in size and plumage.

A number of chickadee species resemble the Black-capped Chickadee. The

Mountain Chickadee *Poecile gambeli* is distinguished from the Black-capped by a white line over the eye. In Canada, it lives only in the mountains of British Columbia and Alberta. The Mountain Chickadee is closely related to the Black-capped, and the two species hybridize, or interbreed, occasionally.

The Gray-headed Chickadee *Poecile cincta* is widely distributed across Asia and Europe. In North America, this brownish-grey chickadee is found in a small corner of the northwestern Yukon and eastern Alaska, where it lives in the willow and spruce woods bordering the treeline. The Boreal Chickadee *Poecile budsonica* has a seal-brown cap, greyish-brown above and dusky white or light grey below with rust-coloured sides. Its cheek patches are

The chickadee makes at least 15 different calls to communicate with its flockmates and offspring. The best known is the *chickadee-dee-dee* that gives the bird its name. Using this call both male and female chickadees challenge or scold intruders, and send information about the location of food and predators to their partners, their offspring, and members of their flock.

Male chickadees also sing a short ditty of two or three whistled notes (one higher and slightly longer, followed by one or two lower, shorter ones): *fee-bee*, or *fee-bee-bee*. Males may sing at any time of the year, but do so mostly in the early part of the nesting season, peaking during territory establishment, nest-building, and egg-laying. Males sing only sporadically during

the day, but serenade their females with a dawn chorus that can last from 20 minutes to an hour.

Habitat and habits

In fall and winter, Black-capped Chickadees live in loose flocks of four to 12 birds. Each flock consists of mated pairs that bred locally the preceding summer, plus unrelated juveniles that have immigrated from surrounding populations.

From October to March, the flock flits from tree to tree over an area of 8 to 20 ha, meandering through long-established forest paths at a rate of about half a kilometre an hour. The birds keep in touch with each other by means of soft notes, *sit-sit*, uttered at intervals. Each flock defends its home range from other flocks using vocalizations and aggressive behaviour.

In the north, the chickadees usually roost in dense evergreen groves sheltered from the wind and snow. At roosting time, some of them disappear into any available hole where they spend the night, one bird to a hole. Others roost in the top branches of evergreens or low down in bushy young spruces. Night after night, the flock may use the same roosting place.

To keep warm the chickadee erects its soft, thick feathers to trap warm air close to its body. This serves as good insulation against the cold.

In early spring, the flock begins to break up, with paired birds spending daylight hours vigorously defending breeding territories from their former flockmates. During this period birds may still roost at night with their flock, especially during cold weather. Once breeding commences, a chickadee rarely strays from the 3 to 7 ha around its nest.

Chickadees establish a dominance hierarchy, or "pecking order," by which each bird is known to the other according to rank. A bird's rank is set by its degree of aggressiveness. Thus all the birds in the flock are subordinate to the most aggressive bird; and the lowest ranking is subordinate to all the others. The rest are graded in between. Typically males dominate females, and adults dominate juveniles. The higher ranking birds enjoy

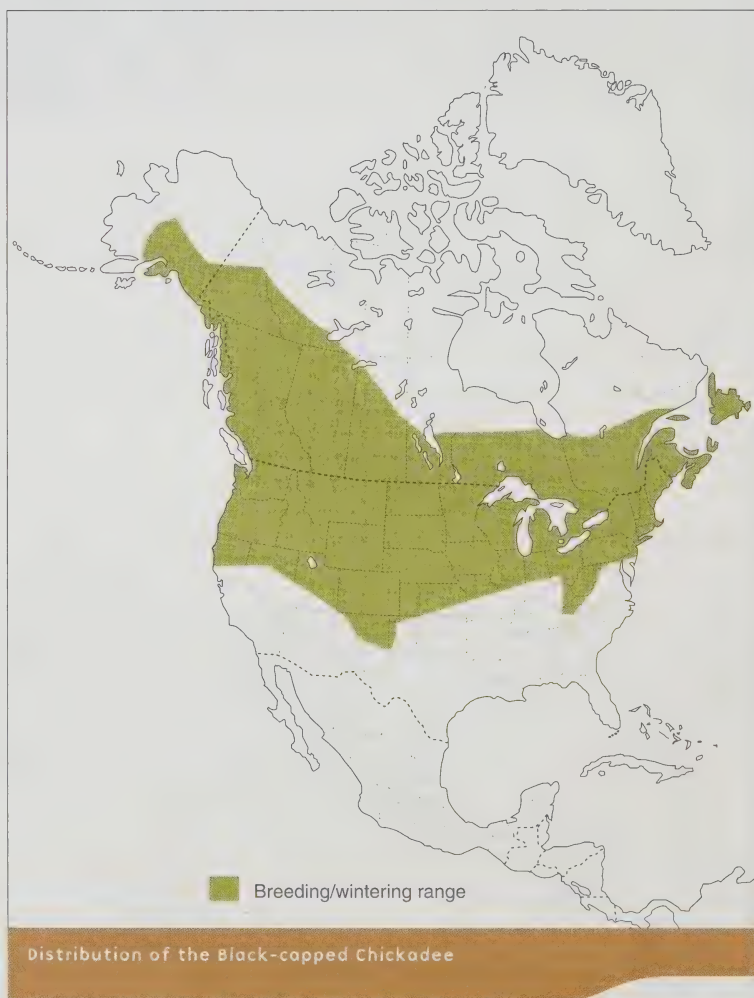
best access to food, the safest spots away from predators, and not only survive better but also have more offspring survive. A dominant bird will threaten, chase, and even fight the subordinate bird, which is always on the defensive and gives way to it. Dominant birds rarely need to fight subordinates once the hierarchy is established. Males and females generally pair according to rank—the dominant male pairs with the dominant female, and so on.

Range

The Black-capped Chickadee is found throughout Canada, from the island of

Newfoundland to British Columbia (except for the coastal islands) and extends northwards into the southern Yukon and Northwest Territories. It lives in tree-covered areas—including woodlots and orchards—where it digs its nest-holes in the soft or rotting wood of trees and finds the food it prefers.

The chickadee is ordinarily a year-round resident, but from time to time large numbers of birds move long distances, generally south in the fall, and north in the spring. These irregular movements, called "irruptions," involve mostly young birds less than a year old. Irruptions may occur due to habitat destruction, or in years when there is a shortage of food,



combined at times with an unusually successful breeding season.

Feeding

From sunrise to sunset, the chickadee spends most of its time feeding. The bird hops along a branch, clutches an upright trunk, or hangs upside down at the tip of an evergreen twig, examining every crevice and cranny for tiny hidden creatures.

The chickadee eats large quantities of insect eggs, larvae and pupae (insects in the torpid stage), weevils, lice, sawflies, and other insects, as well as spiders—about 80 to 90 percent of its diet consists of invertebrates during the breeding season, and about 50 percent during the winter. The chickadee is easily one of the most important pest exterminators of the forest or orchard.

When food is plentiful, particularly in the late summer and fall, the chickadee becomes a food hoarder. It carefully tucks a morsel away under a buckled piece of bark, or in a patch of lichens—often only to pull the morsel out again and repeat the tucking-away ceremony in another place. A chickadee may cache hundreds of food items in a single day, and can retrieve these with almost perfect accuracy 24 hours later. Some birds can remember the location of their food hoards for at least 28 days after caching. Black-capped Chickadees remember not only where they have stored different food items but also which caches they have emptied. As it gets colder, chickadees will tend to select caches with seeds that provide more energy.

Hoarding food is important to the northern birds. This habit provides a meal for whoever finds the hidden morsel, and also ensures extra supplies along customary feeding routes when food is scarce.

It is estimated that chickadees, like other small titmice, need about 10 kcal of energy per day to survive. The birds eat plenty of food which is turned into energy. During the short winter day, the rate of feeding is speeded up. Food not needed for the immediate activity of moving around and foraging is stored as fat. The fat provides energy that the chickadee needs to survive while sleeping and fasting through the

long, cold night. Chickadees also drop their body temperature at night by 10 to 12°C below daytime body temperature, to conserve energy. It is easy to see how important are the foods—sunflower seeds, peanuts, and suet—offered at a feeding station in winter.

Breeding

February and March are courtship months. Calling loudly, the chickadees spend much time chasing each other.

They whirl around a tree in wild pursuit, suddenly stopping as quickly as they started. The flock gradually breaks up into pairs. Each pair travels alone, the female usually in the lead. Wherever she goes, the male defends a small area around her against other chickadees.

By the end of March, the female begins looking for a nesting place. Once it is chosen, the male defends the surrounding area against intruders. This area of 3 to 7 ha forms the pair's territory.

Together, they dig out a hole in the rotting wood of a dead stump, usually about 1 to 3 m above ground. They may also nest 9 to 12 m up in the dead parts of live trees, or in hollows abandoned by other hole-nesting birds.

Although the female looks exactly like the male, by late April she is easily recognized by her voice, which takes on a peculiarly raspy quality as she prepares to lay her eggs. The male feeds the female often, and she accepts his offerings, crouching and shivering her wings like a baby bird. This ceremony is called courtship-feeding. The female makes a soft nest bed in the nest hole, using fine fibres, plant down, and hairs, where she lays one egg a day until there are five to 10; clutches of six to eight are most usual. The eggs are white with fine dark spots.

Only the female incubates, or sits on, the eggs for 20- to 30-minute periods during the day, and for the entire night. While she is on the nest, the male feeds her, but she also leaves to look for food. At this time, the birds are wary and secretive. Should a would-be nest robber darken her nest, the female snarls and hisses in protest. The sound is so startling that it may

momentarily disconcert an attacker, making escape possible.

After 13 or 14 days, the young hatch. The female broods, or warms, the young until they are well feathered. Both parents clean the nest by carrying away the droppings, and feed the nestlings from six to 14 times an hour. A study has shown that feeding and looking after six to eight nestlings can so drain the parents' energy reserve that there are times when they survive only with great difficulty.

After 16 or 17 days, the young are ready to leave the nest. They emerge clean and fluffy images of their parents. Like most other hole-nesting birds, they know how to fly by this time, although their ability increases with practice. For two or three weeks more, the parents continue to feed them, while they gradually learn to feed themselves.

By this time, the parents look worn out. They begin to moult, losing their feathers at a fast rate, and it is easy to tell them apart from the younger generation. The new plumage takes six to eight weeks to grow out fully. After that, young birds can only be told from the older birds by the shape and amount of white on the outer tail feathers. The family may stay together for a short time, but its members soon disperse to join the autumn flocks that tour the woods, feeding and hoarding. Young chickadees typically join flocks from one to several kilometres distant from where they were raised.

Conservation

Black-capped Chickadees are the most widespread bird species across Canada. The most recent surveys suggest that numbers are increasing: Bird Studies Canada's 2001–2002 Christmas Bird Count documented 123 000 individuals, a 25 percent increase over the sample counts of 2000–2001. Since the Christmas Count is only a "snapshot" taken at approximately 300 locations, and since Black-capped Chickadees extend into the United States as far south as northern California across to New Jersey, it is probably safe to assume that Black-capped Chickadees number in the millions. Their success partly results from the increase in

winter bird feeders, since chickadees readily adapt to these "free handouts."

The Black-capped Chickadee's most dangerous predators include bird-hunting hawks and the Northern Shrike. In addition, snakes, weasels, chipmunks, mice, and squirrels enter chickadee nests, or tear them open and eat the eggs or young birds. Adult females are sometimes killed on the nest by weasels.

It is worth our while to encourage and protect the hardy Black-capped Chickadee for the large part it plays in naturally controlling insects and enlivening our forests with its song and movements, even in winter.

Resources

Online resources

Cornell University Laboratory of Ornithology: www.birds.cornell.edu/birdhouse/bird_bios/speciesaccounts/bkcchi.html

United States Geological Survey, Patuxent Wildlife Research Center: www.mbr-pwrc.usgs.gov/id/framlst/i7350id.html

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Catalogue number CW69-4/25-2004E
ISBN 0-662-34270-4

Text: Louise de Kiriline Lawrence
Revision: B. Desrochers, 1988; L. M. Ratcliffe, S. J. Song, S. J. Hannon, 2003
Editing: Maureen Kavanagh, 2003
Photo: Daniel Mennill

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BURROWING OWL



Photo: Gordon Court

undulating, treeless plains. Before its range in British Columbia was restricted to the Kamloops region, the owl occupied dry grasslands and valley bottoms in the Okanagan valley north to Kamloops in the southern part of the province.

Wherever it lives in Canada, the Burrowing Owl uses the abandoned burrows of ground-dwelling mammals to rest, nest, and store food. It relies on short vegetation and tall, weedy areas within 2 km of the burrows for a food supply of insects and rodents, and open terrain beyond these areas for a clear view of approaching predators.

Most Burrowing Owls in Canada live in pastures grazed by livestock and dotted with burrows left where badgers have dug out squirrels for food. Habitat can also occasionally be found on croplands, on roadsides, and—in urban areas—at airports and golf courses, if there are suitable burrows for nest sites.

While many owls are large, solitary birds that live in trees and hunt at night, the western Burrowing Owl is a small bird that lives on the open prairie and in grasslands in Canada, where it nests underground and searches for prey day and night.

Description

The Burrowing Owl *Athene cunicularia* gained its name from a particular behaviour: it nests underground. But contrary to the impression given by the bird's scientific name, which means "little digger," this owl rarely digs its own burrow. Instead, it constructs its nest in burrows vacated by small mammals like ground squirrels, badgers, and prairie dogs.

The adult Burrowing Owl is smaller than a pigeon. It weighs between 125 and 185 g and stands from 19 to 20 cm tall. Its body is generally brown, mottled with white flecks and barred across the chest. This earth-coloured plumage provides good camouflage in the grasslands where the owl lives. The Burrowing Owl's head is rounded, and its eyes and beak are yellow.

The sexes look similar, but the male is slightly lighter in colour. While they resemble the adults for the most part, the young have rusty-coloured throats and buff-coloured breasts without barring; they acquire their adult-like plumage during the late summer.

To discourage predators, the Burrowing Owl can make a noise like the rattling hiss of a rattlesnake's tail. Males will repeat a doleful *coo-coooo*, mainly to attract females. Otherwise, Burrowing Owls make a variety of sounds to each other that are rarely heard by humans.

Habitat and habits

On the dry short-grass prairie, the Burrowing Owl is found on flat-to-gently-

Range

Until the 1970s, the Burrowing Owl had healthy populations in Canada's three prairie provinces but was already gone from the grasslands of British Columbia. Today, it breeds in Alberta and Saskatchewan, with some rare appearances in southwestern Manitoba. In addition, captive-bred Burrowing Owls breed in and some return to the grasslands near Kamloops, British Columbia, where they are introduced each spring.

In the United States, this owl nested from western Minnesota and Iowa south to northern Texas and west to California. Today, its range is considerably smaller (see map). In Mexico, the Burrowing Owl breeds from Aguascalientes north through Coahuila, Chihuahua, and Sonora, and in Baja California.

Burrowing Owls that breed in Canada remain on the breeding grounds from April to September. At that time, the prairie owls migrate 2 500 to 3 500 km to south Texas and central Mexico, arriving in November. Most British Columbia owls migrate to the west coast from Washington to California; a few spend the winter at the inland release sites near Kamloops. The owls that journey to summer breeding

grounds in Canada begin their migration in late February and early March.

Many Burrowing Owls that breed in Canada do not return. Only half of the adult Burrowing Owls come back to their northern breeding grounds, and a mere 6 percent of young owls return to breed in Canada the year after they are born. Scientists have determined that 40 percent of the young owls die in Canada before they migrate in mid-September, but they do not know what happens to the rest of the owl population. They are trying to learn whether the owls that do not return are breeding elsewhere or die in winter.

Feeding

The Burrowing Owl consumes a variety of small creatures. Ground insects, such as grasshoppers and beetles, make up as much as 80 to 90 percent of its diet, but most of its food mass comes from small rodents, such as mice and voles. It also eats frogs, toads, salamanders, snakes, small birds, and dead animals.

Young owls learning to hunt on their own rely mainly on insects for food. They also occasionally scavenge dead animals from roads, and will scurry after insects drawn to warm pavement at night.

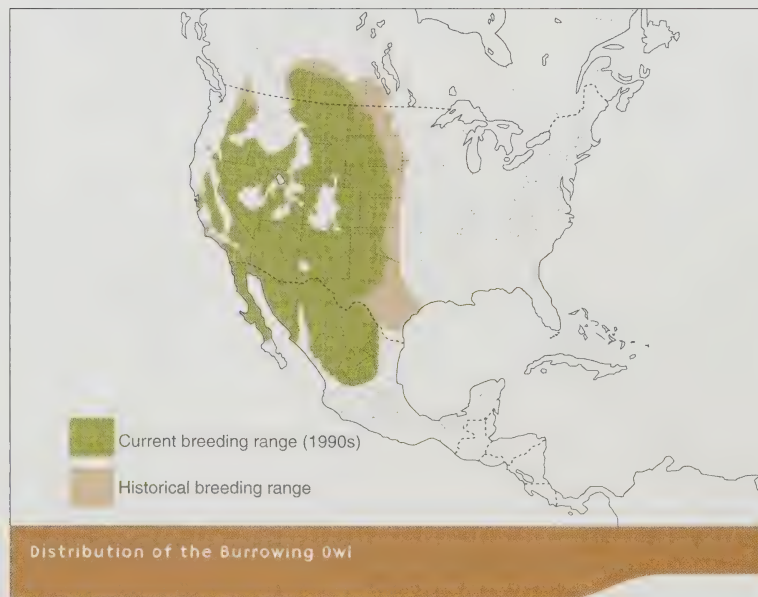
The Burrowing Owl has several hunting methods, including hunting from a perch such as a mound or fence post, running after insects, hovering close to the ground before pouncing on prey, and using its feet to catch insects in mid-air. During the summer, with young to feed, the Burrowing Owl hunts around the clock.

Breeding

The male arrives at its summer breeding grounds in Canada first, in April, and selects a burrow that has been abandoned by badgers or other ground-dwelling mammals. The female arrives shortly afterwards. The owls spend the first two weeks performing elaborate territorial and courtship displays that include flashing white markings, cooing, bowing, scratching, nipping, stretching, and repeated short flights, and the male attracts the female using its *coo-cooo* call. Generally, the birds do not pair for life, although some pairs may reunite for a second summer.

Burrows are important for protection from weather and predators, for raising young, and for controlling temperature. Although the Burrowing Owl does not dig its burrow, it may remove blockages in the tunnel or widen the passage. The male lines the tunnel and nest chamber with dried plants, feathers, and dry, shredded cow manure. This lining may help to keep the burrow cool during the day and warm at night, helping to incubate the eggs. It also humidifies the burrow and may protect the owls from predators by masking the birds' scent. After arranging the nest, the male rarely enters the burrow, but he provides food for the female, who stays underground to incubate the eggs and brood the young. The male lives in a nearby burrow. When Burrowing Owls were more numerous, they nested in burrows that were part of a loose colony. Now, burrows are often isolated.

In Canada, the female Burrowing Owl lays 4 to 12, and on average 9, white eggs that eventually stain a brownish colour from the nest material. The female incubates the eggs for about four weeks, with the eggs hatching in the order in which they were laid. The hatchlings are considered "altricial," meaning that they are born blind and helpless, depending completely on



their parents for warmth and food until they have developed enough to leave the nest.

The Burrowing Owl lays more eggs than it can raise in most years. On average, of the nine eggs laid, one will not hatch, while three to six young will not fledge, or reach the stage where they are capable of flying. Most nestlings die from starvation; the males are unable to provide enough food to keep all the young alive during their first two to three weeks. Cannibalism of young is also common during natural food shortages. The female helps provide food when the young no longer require brooding.

At around four weeks, some of the hatchlings move to nearby burrows, where they wait at the entrances for the adults to feed them. This allows for even food distribution among the young, avoids crowding, and lessens the chance of a predator killing the entire group.

Young owls learn to hunt on their own at about seven or eight weeks and are independent by 10 weeks, in time for the southward migration.

The Burrowing Owl's normal lifespan is three to four years. On rare occasions, a Burrowing Owl may live as long as eight years.

Conservation

At one time, the Burrowing Owl was common in the four western Canadian provinces. Now, it is one of the most endangered birds in these areas. The decline in population began in the 1980s and accelerated during the 1990s to an average rate of 22 percent a year. In 1977, more than 2 000 breeding pairs of Burrowing Owls lived in Canada; by 2000, the number of pairs had dropped to fewer than 1 000.

Human activity has a great impact on the Burrowing Owl. Chemical pesticides, applied to control ground squirrels and grasshoppers, sometimes poison the Burrowing Owl. For example, carbofuran, a pesticide that is now banned, was linked to a reduction in the number of young Burrowing Owls. Owls have also been killed eating strychnine-covered grain left

in burrows to kill ground squirrels. In addition, pesticides kill animals and insects that the Burrowing Owl eats. This may force the bird to hunt far from the safety of its nesting site, making it more susceptible to predators and other dangers.

The extermination of burrowing mammals, particularly badgers and ground squirrels, often killed as "pests," reduces the number of suitable homes for the Burrowing Owl. Fewer of these digging animals means fewer nests and nearby roost, or resting, burrows for the birds.

Burrowing Owls sometimes die along roads. Young owls in particular hunt on and beside roads at night. Because they are slow flyers and have difficulty escaping oncoming traffic, they are often killed.

Habitat loss and changes in the quality of habitat reduce hunting and nesting territories and are associated with low birth and high death rates among Burrowing Owls. In Canada, more than 76 percent of the original prairie grassland habitat has been lost to housing, farming, roads, and energy exploration.

The Burrowing Owl has many natural predators. Badgers, foxes, skunks, weasels, raccoons, and snakes dig up or enter burrows, eating eggs, nestlings, or adult females; other owls, hawks, falcons, domestic cats and dogs, and coyotes prey upon adults and young outside the burrow. Features that humans have added to the Burrowing Owl's territory, such as fences, utility poles, hedgerows and artificial nests for hawks, may give some of the Burrowing Owl's predators more vantage points than they once had.

In 1995, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) declared the Burrowing Owl "endangered," meaning that it may soon no longer exist in the wild in Canada. The Burrowing Owl has been designated "at risk" in all four western Canadian provinces and is protected under provincial wildlife acts. The Convention on International Trade in Endangered Species also protects the Burrowing Owl.

A national Burrowing Owl recovery team, working through Recovery of Nationally Endangered Wildlife (RENEW), a program that includes governmental and non-

governmental groups, approved a recovery plan in 1995 and updated the plan in 2002. This plan aims to increase Burrowing Owl populations in Canada to levels where they can sustain themselves.

In addition, the recovery team members are involved in the experimental release of captive-bred owls in Saskatchewan and the reintroduction of owls in British Columbia. Few of the birds released in Saskatchewan have returned there. Some of the more than 250 birds introduced into the Kamloops region of British Columbia since the program began in 1989 have mated and produced young, and a few have returned to British Columbia the following spring.

Despite its efforts, the recovery team has not been able to identify the key factors behind the population decline. To help it reach some conclusions, the team is working to gather information about migration, winter range, changes on the breeding grounds, mortality, and the effects of various land uses on the owl. However, Burrowing Owls are difficult to track. They are very cryptic, or hard to see because of coloration that camouflages them. They migrate at night and fly alone, not in flocks. In addition, because of their small size, they cannot carry satellite transmitters like those used on larger birds, making it necessary for biologists to attach smaller radio transmitters with shorter ranges.

A number of governmental and nongovernmental programs in Canada's four western provinces are conserving habitat for the bird, studying its habits, banning the use of some pesticides, and raising awareness about the needs of the Burrowing Owl. Through two nongovernmental programs alone—Operation Burrowing Owl in Saskatchewan, which began in 1987, and Operation Grassland Community in Alberta, which started in 1989—more than 700 landowners have conserved roughly 70 000 hectares of Burrowing Owl nesting habitat.

By increasing our knowledge about the Burrowing Owl's habits and changing some of the practices that harm the owls in their nesting areas, we hope we can help the Burrowing Owl regain its healthy numbers in Canada.

Resources

Online resources

Committee on the Status of Endangered Wildlife in Canada (COSEWIC):
www.cosewic.gc.ca

Environment Canada—Burrowing Owl:
glq.pnr-rpn.ec.gc.ca/nature/endspecies/burrowing/db04s00.en.html

Environment Canada—RENEW (Recovery of Nationally Endangered Wildlife):
www.speciesatrisk.gc.ca/recovery

Environment Canada—Species at Risk:
www.speciesatrisk.gc.ca

Government of Alberta Burrowing Owl wildlife status report:
www3.gov.ab.ca/srd/fw/status/reports/bowl/index.html

Operation Burrowing Owl (Saskatchewan):
www.naturesask.com

Operation Grassland Community (Alberta):
www.afga.org/conservation/ogc.htm

University of Wyoming—Burrowing Owl Status Assessment for the Western United States:
uwadmnweb.uwyo.edu/fish_wild/buow/index.html

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Catalogue number CW69-4/101-2004E
ISBN 0-662-34272-0
Text: Geoffrey Holroyd, Dawn Birn
Editing: Maureen Kavanagh
Photo: Gordon Court

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are species at risk, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

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CANADA'S BOREAL FOREST



The boreal forest

- covers more than half of Canada's land mass
- is used by nearly half of the birds in North America each year
- contains wetlands that filter millions of litres of water a day

If you had a clear view of Earth from space, you might wonder at the green band encircling the northern reaches of the globe. You would probably guess that it was an enormous expanse of woodland. What you might not know is that it is called the "boreal forest" and that it makes up almost one third of the world's forests, stretching as it does round the northern parts of North America and Eurasia. You might also be surprised to learn that it is one of the largest forest ecosystems on the planet, and it shelters thousands of wildlife species.

Canada contains about a third of this northern forest, named after Boreas, the Greek god of the North Wind. Stretching more than 5 000 km from Newfoundland and Labrador in the east to Yukon in the west, and extending south 1 000 km from the edge of the arctic tundra, the boreal region occupies more than half of Canada's land area. Many of the species that we think of as being particularly

Canadian—black spruce, jack pine, moose, caribou, gray jays, loons, wood frogs, and lake trout—are part of the boreal ecosystem. The boreal region also contains more than 1.5 million lakes and many of the main river systems in the country. It is home to more than four million people, including most of Canada's Aboriginal people. It is rich in natural resources too, with extensive mineral, oil, and gas deposits, as well as waterways for hydroelectric power. The climate in the boreal forest is characterized by long, very cold, dry winters and short, cool, moist summers.

Boreal species

Plants

The boreal forest is teeming with life. To describe it, let's begin with the trees that make up the forest canopy. There are about 20 species of them, and most are coniferous, which means that they produce their seeds in cones. Spruce, fir,

pine, and tamarack are the main species found in the Canadian boreal forest. Except for tamarack, which drops its needles every fall, they remain green all year. Broad-leaf deciduous trees, such as trembling aspen, balsam poplar, and birch, are also widely distributed across the boreal forest.

Coniferous trees are particularly well suited to the harsh boreal climate. Their conical shapes reduce snow buildup on branches in winter, so that they do not break under the snow load. Their narrow needles have thick waxy coatings which protect the trees from drying winds. These needles have tiny pores which allow gases to move in and out of the trees: this is how they "breathe." These pores are sunken into the waxy layer, to help reduce water loss.

In order to grow, plants need to photosynthesize—a process that converts energy in sunlight into food for the plant. To thrive in the short boreal summers, conifers have adaptations to help maximize photosynthesis. For example, because their foliage remains green year-round, conifer trees can photosynthesize in the spring without having to grow leaves first. In fact, they can even photosynthesize on warmer days in the winter.



The deciduous trees, such as aspen, are also adapted to the boreal conditions. They grow leaves to photosynthesize in the summer, and then shed them before it gets cold in winter. In this way, the trees are less damaged by heavy snow-falls. Before the leaves fall, the trees take back some of the nutrients from the leaves, to use in the next year's growth. Aspens also have chlorophyll (green cells that are needed for photosynthesis) in their bark, so that they can make some food in winter on warmer days.

All of these tree species support a range of birds, mammals, and other wildlife. They also store large amounts of carbon and produce a great deal of oxygen, so much that in the spring and summer in the northern hemisphere, when the boreal trees are growing most vigorously, worldwide levels of carbon dioxide fall and global levels of oxygen rise.

While trees are the dominant plant species, many other plants thrive in the boreal forest, including shrubs, mosses, and lichens. Some shrubs, such as

willow, alder, blueberry, red-osier dogwood, and honeysuckle, produce bright-coloured or conspicuous berries that attract fruit-eating birds and provide food for mammals from small rodents to bears.

Under coniferous trees, mosses grow so thickly that they form a complete carpet on the soil's surface, keeping the soil moist and cool and preventing many other types of plants from growing. Open areas are carpeted with yellow, green, and light grey lichens. Some lichens grow on wood too. Lichens are combinations of fungi and algae that benefit each other: the underlying fungus provides structural support for the lichen, while the algal layer on top has chlorophyll which provides food for the lichen through photosynthesis. Lichens remain intact all year long, and are an important food source in winter for species such as caribou.

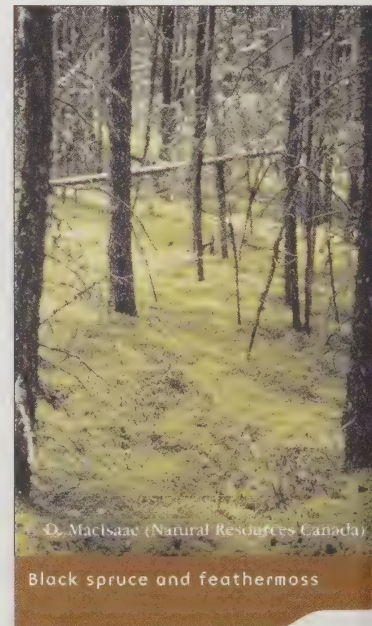
Wetlands—bogs, fens, and marshes—occupy 30 percent of Canada's boreal forest. Boreal wetlands are often referred

to as muskegs or peatlands. These peatlands are usually on poorly drained, flat terrain. Plant material decomposes slowly in the cool, wet soil conditions, forming a blanket of material that is often several metres thick. Sphagnum and other mosses, sedges, and low shrubs make up the peatland vegetation. Treed peatlands, composed mostly of tamarack and black spruce, are also widespread. Some mosses, such as sphagnum, are especially important in peatlands where they can create acidic environments.

These wetlands are invaluable: they filter millions of litres of water every day, and they provide breeding, moulting, and staging (resting and feeding) habitat for more than 13 million ducks—about 40 percent of the North American duck population.

Birds

Nearly half of the birds in North America rely on the boreal forest at some time during the year. It is estimated that at least 3 billion landbirds, water birds, and shorebirds breed in the boreal forest each year, representing more than 300 species. Another 300 million birds, including several species of shorebirds, swans, and geese, breed farther north and travel through the boreal forest during migration.





© K. Harrison (Canadian Wildlife Service)

Cape May Warbler

Many of the birds that we see in our communities have bred in the boreal forest or passed through it travelling north or south, and many of these are the singers of the forests—small birds such as warblers, vireos, thrushes, kinglets, grosbeaks, sparrows, and flycatchers—which are hard to see but wonderful to hear. Ducks, loons, grebes, rails, gulls, kingfishers, and cranes depend on Canada's boreal waters for nesting and for food.

Other bird species, such as woodpeckers, finches, nuthatches, chickadees, owls, grouse, and ravens, can live in the boreal forest year-round, having adapted to the climate. Black-capped chickadees, for example, have black and white feather patterns that are designed to absorb heat and provide the best insulation when they are sleeping. They can also sleep in holes in the snow which act like tiny igloos to keep them warm. In winter, Great Gray Owls use their extremely sensitive ears and silent flight to locate and capture small mammals under the snow, and Ruffed Grouse grow scales on the sides of their toes that turn their feet into snowshoes.

Mammals

The boreal forest shelters more than 85 species of mammals, including some of the largest and most majestic—wood bison, elk, moose, woodland caribou, grizzly and black bears, and wolves—and smaller species, such as beavers, snowshoe hares, Canada lynx, red squirrels, lemmings, and voles. Of these,

the snowshoe hare is the most ecologically important. It is a food source for many of the boreal forest's predators (both mammals and birds) and feeds on the forest's various plants and shrubs, linking all of these species in a tight food web.

Like other species, many mammal species have adapted to conditions in their boreal home. For example, the snowshoe hare turns from brown-grey in the summer to white in the winter, so that it always blends with its surroundings. Moose, wood bison, and other large mammals have a low surface area-to-volume ratio, which minimizes the amount of body heat they lose in winter.

The beaver is one of the most important animals in the boreal forest. Using its ever-growing front teeth, it fells trees and eats the leaves, twigs, and bark, using the wood to build dams and lodges. Beaver dams flood parts of the forest, creating ponds and wetlands that are used by fish, waterfowl, and amphibians.

Reptiles and amphibians

The boreal forest is a challenging home for reptiles and amphibians, which depend on environmental conditions to regulate their body temperatures. Spring and summer temperatures likely limit how far north many species are found,

since temperatures must be high enough for eggs to hatch and young to grow. In summer, reptiles and amphibians choose appropriate habitat and bask in the sun to reach body temperatures that allow them to hunt effectively and digest prey. In winter, most amphibians and reptiles that hibernate on land seek out sites underground where temperatures consistently remain above freezing, although wood frogs and chorus frogs simply burrow in the leaf litter and depend on chemicals to make them freeze-tolerant; during hibernation, more than 40 percent of their body fluids can consist of ice. Other frogs and turtles hibernate at the bottom of ponds and lakes.

Insects

Insects are critical components of boreal food webs and play important ecological roles as pollinators and decomposers, yet as a group, they are among the most poorly understood organisms in the boreal region. Except for relatively few species, mainly those considered "pests" because of the economic losses they cause by damaging or killing trees, or highly conspicuous groups such as butterflies, little more than the names and general habitat preferences is known.

It is estimated that 32 000 insect species inhabit Canada's boreal forest, although



© Michael (Nathalie) Gauthier / iStockphoto

Beaver dams

about one third of these species have yet to be described. Among the known species, several are particularly well adapted to their habitat. For example, black fire beetles have infrared sensing organs on their bodies that allow them to track the heat of forest fires as they search for freshly burned trees on which to lay their eggs. Other species, like the white-spotted sawyer beetle, use their long antennae to sense chemicals in smoke and charcoal to achieve the same goal. Like many other insect species, in addition to starting the decomposition of fire-killed trees, these two beetle species are an important part of the diet of several bird species commonly found in burned forests.

Fish

Canada's boreal forest is home to about 130 species of fish. Most fish species in the boreal region are small, like minnows and stickleback. Larger species, including walleye, northern pike, lake trout, Arctic grayling, yellow perch, brook trout, whitefish, and burbot, are some of the most common game fish.

Fish living in the boreal forest are a hardy bunch, as they have to contend with long winter months and cold temperatures. Numerous fish species also migrate between different areas of rivers and lakes at different times of the year. For instance, many populations of bull trout live in different areas of the river during the winter, summer, and fall. Perhaps the largest migrations are completed by chum salmon and chinook salmon in the most northwestern portion of the boreal forest. These species are born in small streams, but migrate to the ocean, where they grow and mature, before migrating back into rivers to reproduce and die. The majority of them return to the same area where they were hatched, and migrations of several hundred kilometres are common.

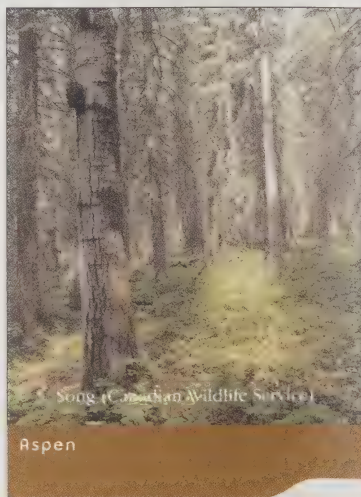
Some fish, like northern pike and walleye, feed on other fish species; species such as lake trout, white sucker, lake sturgeon, and lake whitefish eat aquatic insects and other invertebrates; still others, such as yellow perch, cisco, and many minnow species, feed on tiny zooplankton in the water. In turn, fish are food for eagles, osprey, herons, loons, mergansers, bears, and otters.

Benefits

The boreal region not only supports the species that live within it; it also provides benefits that extend beyond its borders. The forest's extensive wetlands lessen the effects of floods and droughts by storing and moderating the flow of water between upland areas and lowland regions. Its wetlands also act as water filters by removing impurities from the water that flows through them.

The boreal forest's trees and other vegetation help to control erosion, improve the cycling of nutrients, and promote the formation of soil. Sometimes natural disturbances, such as forest fires, contribute to plant growth. Fires release nutrients that were tied up in leaves, logs, and needles on the forest floor, which can aid in the vigorous regeneration of vegetation following fire. The forest also helps to regulate the earth's climate by storing carbon in peat deposits, soils, lake sediments, and trees. This prevents atmospheric carbon from being released as carbon dioxide and methane, two gases linked to climate change.

As one of the few remaining relatively intact ecosystems on our planet, the boreal forest helps to preserve biodiversity, or the variety of life on Earth. Every living thing plays an essential role in maintaining a balance in Earth's natural processes. That's why biodiversity is so important. And that is why the boreal forest is important too. The Canadian



Song (Canadian Wildlife Service)

Aspen

boreal forest is home to about two thirds of Canada's 140 000 species of plants, animals, and micro-organisms.

Economic activity in the boreal forest sparks other benefits. It brings products to people around the world and supports the people who live and work in the boreal region. Much of the world's forestry, mining, oil and gas production, hydroelectric generation, tourism, and harvesting of natural products occur in the boreal forest. About 14 percent of Canadians living in hundreds of communities located in the boreal region rely on these industries. Others make their livings on land at the southern edge of the boreal forest that has been converted into farmland. The boreal forest is home for about 80 percent of Canada's Aboriginal peoples, whose rich heritage is strongly linked to the forest.

Disturbances and threats

Unfortunately, there are negative aspects to development in the boreal forest. The main consequences are habitat loss and fragmentation. These occur when land is cleared for farmland or flooded to make reservoirs for hydroelectric generating stations or when seismic lines, pipeline rights-of-way, forestry roads, and mine sites are cut into the forest. These activities in some cases weaken its natural systems and disturb wildlife species that depend on large, intact areas or require a specific habitat to survive. These impacts or changes to boreal ecosystems, along with pollution from some of these industries and the diversion of water flow sometimes caused by hydroelectric and mining developments, can have serious consequences for wildlife.

While the boreal forest harbours few species at risk, some species are being affected by human disturbances. The most well-known species at risk found in the boreal region are some populations of woodland caribou, the wood bison, the Peregrine Falcon, the Yellow Rail, and the Whooping Crane. Maintaining boreal habitat in protected areas has helped in the slow recovery of the wood bison and the Whooping Crane, both of which almost disappeared in the first half of the twentieth century.



Conversion to agricultural land modifies or destroys wildlife habitat and may greatly change the amount of carbon that can be held in the ecosystem. Forests hold between 20 and 100 times more carbon than do agricultural crops, and they keep the carbon for longer periods.

Another threat is climate change. Global increases in temperatures could bring more frequent and severe disturbances from fire and insects, for example, changes in the quantity and quality of water, and a gradual migration northward of the forest itself. In western Canada, many of the species found in boreal lakes are near their thermal limits in normal conditions; a few degrees of

warming could cause them to decline or disappear. Climate change is also likely to decrease biodiversity by filtering out species that do not move or spread easily and by favouring less diverse and more aggressive, invasive, species.

The boreal forest is strongly influenced by natural disturbances, such as wildfires, insects, and disease, as well as human ones. Some of these disturbances can be positive. For example, many species are adapted to thrive after fire in the boreal region. Pine trees release seeds when a fire's heat opens their cones, and species such as fireweed and aspen regenerate right after fire, often from roots and shoots that survive in the soil.

Action

Many people are taking steps to help the boreal forest remain healthy. Governments are examining the combined effects of development pressures and are trying to find ways to reduce the impacts. Environmental organizations are working to raise awareness about the boreal forest and conducting programs to help maintain the forest's health. Industry is making efforts as well. The forest sector is reducing the impact of forestry on boreal water resources and is identifying areas critical for biodiversity. Although overall exploration activity is increasing, some oil and gas companies are working to decrease their impact by reducing the size of seismic disturbance when they look for

oil and gas, and the electricity industry is working to maintain healthy populations of fish and wildlife during the design, operation, and maintenance of facilities. Finally, individuals are getting informed about the boreal forest and are taking action, like reducing, reusing, and recycling paper products, and adopting alternative energy sources.

While all of these actions will help reduce the impacts on the boreal forest, a big challenge is managing the boreal region in a sustainable manner. To do this, scientists are working to increase our knowledge, trying to understand how boreal ecosystems function, how human activities affect the forests, and how we can make better decisions about those activities. Greater scientific understanding, along with a wealth of traditional knowledge, can be used to sustain our magnificent boreal forest now and for generations to come.

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Model Forest Network:
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Catalogue number CW69-4/107-2006E
ISBN 0-662-43235-5
Contributors: P. Blancher, S. Bradbury, T. Cobb, C. Fisher, K.C. Hannah, B. Johns, J. Lane, D. MacIsaac, C. Paszkowski, G. Scrimgeour, S.J. Song, 2006
Editing: M. Kavanagh, 2006
Maps: The world's boreal forests: Reproduced with the permission of The Atlas of Canada, Geomatics Program, Earth Sciences Sector, Natural Resources Canada, 2006.
The boreal forest in Canada: Reproduced with the permission of the Canadian Forest Service, Natural Resources Canada, 2006.
Page 1 photo: Black spruce peatland

The Canadian Wildlife Service

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COMMON EIDER



Photo: Grant Gilcheist

This bird

- is the largest duck in the northern hemisphere
- may nest in colonies of 10 000 or more
- lines its nest with down feathers from its own body
- does not eat for more than three weeks when it is incubating its eggs
- often has "aunts" which watch over it when it is a duckling

Description

The Common Eider *Somateria mollissima* is the largest duck in the northern hemisphere. It weighs an average of 1 800 g, but its weight can vary from 850 to 3 025 g depending on race, sex, and time of year. There are four Common Eider races in North America; subtle differences in body size and bill structure distinguish each race from the other.

The plumage of the Common Eider varies considerably. It passes through several stages while the bird is growing to maturity, and after the bird reaches adulthood at about three years old, the plumage alternates between two colours each year as a result of moulting, or the replacement of old feathers with new. In addition, the male's plumage differs from the female's.

Between the ages of three weeks and three years, male Common Eiders moult

their feathers eight times, changing their colour from a juvenile blackish brown to an adult olive-brown and white in winter and a striking black and white, with a small area of light emerald green on the back and sides of the head, during the breeding season. Changes in female plumage are less dramatic: from a juvenile blackish brown, the duck becomes rusty-to-tan. The female's summer colours provide good camouflage in the vegetation and rocks of the offshore islands on which she breeds.

Common Eiders can live 20 years, one of the longest lifespans among sea ducks. However, the expected lifespan for eider populations which are heavily harvested may be much shorter.

Signs and sounds

Ducklings utter a number of sounds, ranging from a high-pitched note of contentment, which they give especially

when they are feeding in the water, to a distress call—a monosyllabic piping.

When they are alarmed, adult Common Eiders emit a series of hoarse *kor-korr-korr* notes. When courting, drakes give a haunting call much like the cooing of pigeons, which can travel great distances across water on calm days.

Females are less vocal than males. They produce a series of throaty calls during courtship and feeding and an abrupt *cluck-cluck-cluck* when defending their ducklings from avian predators such as herring gulls.

Habitat and habits

Of all sea ducks, the Common Eider is the most closely tied to marine habitat. It lives in arctic and subarctic coastal marine areas, where it frequents coastal headlands, offshore islands, skerries, and shoals. The Common Eider rarely leaves the water in the winter, and some races remain as far north as there is open water.

The four races of Common Eiders in North America have different breeding ranges. The southern race *Somateria mollissima dresseri* breeds from Maine to Hamilton Inlet on the Labrador coast; the northern race *Somateria mollissima borealis* breeds from northern Labrador

to Ellesmere Island in the eastern Canadian Arctic; the Hudson Bay race *Somateria mollissima sedentaria* remains all year within Hudson Bay; and the Pacific race *Somateria mollissima v-nigra* breeds from Coronation Gulf in the MacKenzie District of the Northwest Territories to the south side of the Alaskan peninsula. Three subspecies are found outside North America: one in northwest Europe, one in Iceland and a third in the Faeroe Islands north of Great Britain.

The Common Eider belongs to the sea duck tribe (Mergini), which contains closely related ducks, all of which use marine habitats to some degree. The King Eider *Somateria spectabilis*, Spectacled Eider *Somateria fischeri*, and Common Eider all belong to the same genus, and hybridization is known to occur between Common and King Eiders.

Eider ducks are gregarious, travelling and feeding in flocks numbering from tens to thousands.

Unique characteristics

Young Common Eiders often benefit from the care of "aunts," which are nonbreeding females. These "aunts" gather around nests containing hatching eggs or newly hatched young and accompany the ducklings to the water with their mother and help to protect the young from predators.

Another noteworthy practice is the Common Eiders' habit of gathering in compact flocks at night, sometimes offshore, at other times in the protection of a headland or cove. Folklore claims that under very cold conditions some eiders move around the outer ring of the flock in order to keep the water from freezing. Although this behaviour has not been documented by scientists, it is known that in winter when the temperature drops eiders protect themselves in other ways. They minimize their energy expenditure by becoming inactive, not feeding and, presumably to insulate themselves, gathering in groups so dense that individual ducks cannot be counted.

Range

Common Eiders breed along much of the coast of northern North America,



south to Maine in the east and south to the Alaska Peninsula in the west. In winter the various races shift southward, even as far as Florida on the eastern seaboard and to the coast of Washington in the Pacific. However, the bulk of the Atlantic coast eiders winter in Newfoundland and Labrador and on Cape Cod, Maine, and most of the Pacific eiders winter in the Aleutian Islands in Alaska.

The four races of Common Eider that breed in Canada follow a wide range of migration patterns. Most eiders migrate in spring and fall, some travelling long distances, others short; some populations remain in the same area year-round.

Common Eiders that migrate in spring travel rapidly. Most birds fly along the coast, though some individuals are known to cross over significant tracts of land, such as the Nova Scotia–New Brunswick border region or the isthmus of the Avalon Peninsula on the island of Newfoundland. They travel in compact flocks of a few to thousands, flying low to the water and travelling at speeds of 60 to 70 km per hour.

Fall and winter migration is slower and more leisurely. During this migration, eiders rarely cross land, usually only flying over projecting points of land or headlands, and then only under certain weather conditions, such as snow and onshore winds. The eiders of the inner Gulf of St. Lawrence are an exception, many of them moving first southwest into the St. Lawrence estuary a little downstream of Quebec City and then flying over much of the state of Maine.

Eiders begin to migrate south in the late fall. The timing is largely influenced by freeze-up and by the growth of pack ice, which occurs progressively later as one proceeds south and is a more important influence in the northwest Atlantic than elsewhere. There is generally a supplanting effect: birds from farther north replace those that have bred and migrated south.

In June and July, males, or drakes, and nonbreeders make moult migrations to replace their worn-out plumage with new plumage in an area where they will be protected from weather and predators. They often move several hundred

kilometres north from their breeding areas. During the moult, the eiders are unable to fly for three to four weeks, and the ducks lose weight as energy is used to grow new feathers. By mid-September, the drakes have resumed flight and are ready to return to the wintering grounds. However, they travel separately from the females and young, and often arrive later at the wintering grounds than these two groups, even though the adult females moult later, in August and September.

Feeding

Eiders feed during the day by diving to the bottom in waters from 3 to 20 m deep to take mussels, clams, scallops, sea urchins, starfish, and crabs, which are swallowed whole and crushed in the large gizzard.

In winter, when daylight is short, more than half the daytime hours are spent in feeding. The ducks feed in shoal waters off headlands and offshore islands and skerries. Flocks move together at the same rate, the ducks at the front of a flock diving first and the rest following sequentially. After 15 to 30 minutes of intensive feeding, flocks move offshore to rest, preen, and digest the contents of the gullet. The feeding sequence is then repeated.

During spring migration, and when the eider ducks arrive near their breeding places, much time is spent feeding, and the birds accumulate fat. These stores are particularly important for the breeding females, or hens, which rely on the reserves through the incubation period. Unlike many ducks, the hen does not feed once she starts sitting on her eggs.

The young apparently eat insects during their first week of life.

Breeding

Eiders return to the breeding islands along the northern coasts as soon as shorefast ice or pack ice starts to dissipate. Many eider ducks are paired when they arrive on the breeding grounds, although some pairing occurs there. Some races remain paired for several years, others do not. Courtship is very intense in spring, with males making displays for the females which include the upward tossing of the head, cooing, neck-stretching and wing-flapping.

Courtship continues after pairing in order to maintain pair bonds.

Some female eiders may breed in their second year of life, but males do not breed until they are three years old. Many females will not breed in some years. Common Eiders breed mainly on small offshore marine islands or isolated spits and points that are free of mammalian predators. Within a couple of weeks of arriving at the breeding grounds, the birds make prospecting flights and visits to choose a suitable nesting place. Often females will use the same nesting site for a number of years, while others choose new nest sites each year. They nest in early summer in dense colonies of tens to 10 000 or more; nesting starts progressively later as one proceeds farther north. There is one brood per season.

Only the female prepares the nest. In some races, the male stays with the female for a while; in others, he does not. When he remains, the male defends the female from other eiders and from gulls and ensures that she does not mate with other males.

The female begins laying the eggs a couple of days after the nest is ready. There are usually four or five eggs per nest, and generally, one egg is laid per day. When the second or third egg has been laid, the female lines her nest with down plucked from her body. While laying the eggs, some females will leave the nesting colony, possibly to feed before they return to the nest to incubate, or sit on the eggs, continuously. Once incubation begins, the female only leaves the nest for as little as five minutes every two or three days to drink, but not to eat. During early egg-laying, if the male is still in the vicinity, he accompanies the female on her breaks. By mid-incubation, most males have left the colony on their moult migrations. Incubation lasts from 21 to 24 days, and about 50 to 70 percent of the eggs hatch successfully.

The downy newborns leave the nest within 24 hours, and they feed themselves. Within one hour of entering the water, they can dive competently. Young first fly when they are 60 days old. Generally, few survive to fly; many are lost to predators, exposure, or starvation in their first week of life. In good years,

one duckling per adult pair may survive for the fall flight. On the other hand, adults are often long-lived, and estimated annual survival rates vary from 80 to 95 percent. This low reproductive success, which is compensated by high adult survival, is very characteristic of eiders and other sea ducks such as scoters and Long-tailed Ducks. Most other ducks breed more successfully but lose 40 to 50 percent of adults each year.

The mother's relationship with her ducklings ends when she leaves for the moult migration in the autumn. In the fall migration, groups of young may travel together and arrive before the adults on the winter range.

Conservation

The main predators of Common Eiders are large gulls, ravens, American crows, and jaegers, which prey on the eggs and the downy young. Because they nest mostly on small islands, Common Eiders have few mammalian predators. Sometimes arctic foxes or red foxes may inflict some damage, and if polar bears come ashore at nesting colonies, they can destroy all the nests and kill many nesting females.

Common Eiders also fall victim to starvation in years of low food supply, and sometimes brooding females will die of starvation during the incubation period when they do not leave their nests.

Hunting has taken a heavy toll. Before the introduction of hunting regulations, breeding stock of Common Eider were greatly reduced, to the point of some local extinction in widely scattered breeding areas. Fortunately, this bird responds well to adequate protection, and not only has reoccupied lost areas but also, in recent decades, has extended its breeding range in western Europe, the British Isles, Atlantic Canada, and elsewhere.

Such recoveries in eastern North America began quite soon after the enactment in 1916 of the Migratory Birds Convention between Canada and the United States, which limits hunting of migratory birds. The Common Eider was given special recognition at that time because of the greatly diminished breeding stocks along the eastern seaboard. Eider ducks in most areas recovered dramatically at

rates of up to 12 percent per year; for example, in Maine, the number of nests increased from fewer than 100 in one colony in 1910 to more than 20 000 nests in over 75 colonies by 1970. Scientists have not determined how many Common Eiders live in Canada today.

In Newfoundland and southern Labrador, breeding stocks have yet to recover to any extent. This is partly because, until 1949, when Newfoundland entered Confederation, these areas were not bound by the provisions of the *Migratory Birds Convention Act* and partly because of the lack of adequate public education and enforcement of hunting regulations under the Act. Illegal hunting and taking of eggs during the spring and early fall, when the local breeding population is present, has kept the number of local breeders low.

Another cause for concern is the harvest in southwestern Greenland of the wintering northern Common Eider (*S. m. borealis*), which breeds in the eastern Arctic of Canada and in west Greenland. It is thought that the harvest may not be sustainable and that the population there may be in decline.

In addition, the Pacific race of common eider (*S. m. v-nigra*) has experienced dramatic population declines since the 1980s for unknown reasons.

In Canada, recreational hunting of eider is permitted during a winter hunting season, even in Newfoundland and

southern Labrador. This is because the eiders present on the Newfoundland and Labrador coasts and in the Gulf of St. Lawrence during the winter are not local breeders: they belong to larger Arctic breeding populations.

Increased focus on public education and enforcement and the promotion of other uses of eiders, such as the harvesting of down, is laying the groundwork for a recovery of breeding stocks. Eider down is one of the lightest and most effective insulators known. It commands high prices on the world market and is used in products such as parkas, sleeping bags, and comforters. The down can be collected without damaging the ducks or their eggs and nests. Eider down harvesting occurs in the Gulf of St. Lawrence and in Nunavut, and recently there has been interest in the potential of this activity in Newfoundland and Labrador. In Iceland where there are significant eider down farms and the eider down harvest is a multi-million dollar industry, eiders are protected against hunting all year around.

Resources

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Sea Duck Joint Venture (a joint venture under the North American Waterfowl Management Plan): www.seaduckjv.org

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Catalogue number CW69-4/72-2003E
ISBN 0-662-34277-1

Text: Ian Goudie

Revision: Ian Goudie, 1996; Grant Gilchrist, 2003

Editing: Maureen Kavanagh, 2005

Photo: Grant Gilchrist



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are species at risk, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

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Également disponible en français sous le titre *L'Eider à duvet*

HINTERLAND WHO'S WHO

DOWNY WOODPECKER



This bird

- is the smallest woodpecker in North America
- nests in a hole the adults make in a tree
- has a long, barbed tongue and sticky, glue-like saliva, which help it catch insects
- lives year-round across much of North America
- is the most common woodpecker in eastern North America

Description

Of the 198 species of woodpeckers worldwide, 13 are found in Canada. The smallest and perhaps most familiar species in Canada is the Downy Woodpecker *Picoides pubescens*. It is also the most common woodpecker in eastern North America.

This woodpecker is black and white with a broad white stripe down the back from the shoulders to the rump. Its wings are checkered in a black and white pattern that shows through on the wings' undersides, and the breast and flanks are white. The crown of the head is black; the cheeks and neck are adorned with black and white lines. Male and female Downy Woodpeckers are about the same size, weighing from 21 to 28 g. The male has a small scarlet patch, like a red pompom, at the back of the crown.

The Downy Woodpecker looks much like the larger Hairy Woodpecker *Picoides villosus*, but there are some differences between them. The Downy's outer tail feathers are barred with black, unlike the Hairy Woodpecker's, which are all white. The Downy is about 6 cm smaller than the Hairy, measuring only 15 to 18 cm from the tip of its bill to the tip of its tail. And the Downy's bill is shorter than its head, whereas the Hairy's bill is as long as or longer than its head length. The Downy's name refers to the soft white feathers of the white strip on the lower back, which differ from the more hairlike feathers on the Hairy Woodpecker.

Woodpeckers are a family of birds sharing several characteristics that separate them from other avian families. Most of the special features of their anatomy are associated with the ability to

dig holes in wood. The straight, chisel-shaped bill is formed of strong bone overlaid with a hard covering and is quite broad at the nostrils in order to spread the force of pecking. A covering of feathers over the nostrils keeps out pieces of wood and wood powder. The pelvic bones are wide, allowing for attachment of muscles strong enough to move and hold the tail, which is important for climbing.

Another special anatomical trait of woodpeckers is the long, barbed tongue that searches crevices and cracks for food. The salivary glands produce a sticky, glue-like substance that coats the tongue and, along with the barbs, makes the tongue an efficient device for capturing insects.

Signs and sounds

As early as February or March a Downy Woodpecker pair indicate that they are occupying their nesting site by flying around it and by drumming short, fast tattoos with their bills on dry twigs or other resonant objects scattered about the territory. The drumming serves as a means of communication between the members of the pair as well. Downys also have a variety of calls. They utter a *tick*, *tcick*, *tcerrick*, and both the male and the female add a sharp whinnying call during the nesting season.

Hatchlings give a low, rhythmic *pip* note, which seems to indicate contentment. When a parent enters the nest cavity, the nestlings utter a rasping begging call, which becomes stronger and longer as the chicks mature.

Habitat and habits

Woodpeckers live where trees grow. The Downy Woodpecker is at home in a variety of wooded areas across its range, in the northern mixed forests and in the deciduous forests farther south, in woodlots and parklands, in orchards, and even in city parks and neighbourhoods. It prefers places where broad-leaved trees, such as poplars, birches, and ashes, let in the light among the evergreens. Forest edges and areas around openings in the denser forests are also favoured places. In the western part of its range, the Downy Woodpecker can be found in alder and willow growth. The Downy shares these habitats with other kinds of woodpeckers, but there are differences in their selection of nest sites and in their choice of food. Each species thus occupies its own niche in the environment.

Like most woodpeckers, the Downy is a climber. Its short legs and two toes pointing forwards and two backwards on each foot give the bird an excellent grip for climbing. It climbs by propping its stiff, sharply pointed tail feathers against the support while shifting its leghold. With its body close to the trunk or branch and its head bobbing, the bird “hitches” upwards, backs down spiralling, and nimbly darts sideways at incredible speed.

Unique characteristics

As the smallest North American woodpecker, the Downy can drill cavities in dead trees or limbs that measure as little as 10 cm around. This means that it can live in a wider range of habitat than can larger woodpeckers, which require bigger trees in which to create their nests.

Range

The Downy Woodpecker is found over the greater part of the North American continent, from the states bordering the Gulf of Mexico northwards. In Canada in the northernmost part of its range, it is found from the island of Newfoundland across to James Bay, the northern Prairie



Distribution of the Downy Woodpecker

Provinces, the southern Mackenzie District of the Northwest Territories, northern British Columbia, and Yukon. Downy Woodpeckers in the northern parts of the range migrate southward in the winter, but these migrations, which depend on the available food supplies, are somewhat irregular.

Feeding

In the spring and summer the Downy Woodpecker feeds on flying and hidden insect life, as it becomes available. After the young hatch, the need to select food suitable for the nestlings at various stages of growth and gradually to increase the speed of the feedings compels the Downy Woodpecker to seek larger and more easily caught prey, such as caterpillars, mayflies, and moths. The Downy also eats small wild fruits in season.

After the nesting period, the Downy Woodpecker resumes its specialized feeding habits. It hunts down small insects and larvae that infest trees and lie hidden in cracks and crannies along

branchlets, twigs, and trunks. In fact, the Downy consumes enormous numbers of insects. More than 75 percent of the bird's diet consists of insects, a large portion of which include wood-boring beetles and other insects that affect the economy. For example, one study has showed that Downy Woodpeckers reduced the overwintering population of codling moths, a major threat to apple orchards and other fruit-growing operations, by 52 percent. Other studies have shown that Downys help suppress bark beetle infestations. During the 1950s and 1960s, the Downy Woodpecker in eastern North America fed extensively on the elm bark beetle, which was responsible for dispersing Dutch elm disease.

The Downy's small size enables it to hunt along the upper branches of trees, while the larger, heavier woodpecker species concentrate on more solid areas such as the trunk. Unlike some other species, such as the Red-headed Woodpecker *Melanerpes erythrocephalus*, Downy Woodpeckers do not

cache, or hide, food for winter. During the winter a pair of Downy Woodpeckers may do a thorough job of ridding an infested tree of tiny scale insects. With its sharp bill boring small round holes or prying open the insects' hiding places, the woodpecker fetches out food with its long agile tongue. Often the birds spend most of the daylight hours going over areas of good yield in the same trees, until they retire just before sunset, each to its own sleeping hole in the trunk of a tree.

Males tend to forage on smaller branches where more food is available, females on larger branches and trunks of trees. Scientists believe that this behaviour is related to male dominance. The extent and pattern of these differences may vary from region to region.

Breeding

Downy Woodpeckers breed during the first breeding season following the year they were born. They usually form pairs in early spring and will often return to the same nesting area of approximately 2 ha every year of their adult life. Male and female Downys usually occupy separate sleeping holes in the trunks of trees, and they may even select the same sleeping holes they had excavated in an earlier season.

During the breeding season Downy Woodpeckers defend their territory against other Downys that trespass. Encounters with intruders result in hostile displays: the opponents parade in front of each other in threatening poses, with bills gaping and wings raised and fully opened, the birds twisting and turning like small windmills. The Downy male engages the male trespassers and the female the females, while their respective partners look on. These demonstrations may continue for several hours but seldom end in actual fighting. Usually the intruder is chased away or simply disappears.

After establishing their territory, the Downy pair look for a suitable tree in which to excavate their nest cavity. They are especially attracted to dead trees or stubs dotted with old holes from former nestings. They may start several holes in different trees before the final choice is made, usually by the female. The

entrance hole is round and is usually from 3.6 to 9.0 m above ground, although it may be higher or lower.

The pair require about two or three weeks to excavate their nest hole, which measures from 12 to 15 cm wide and about 20 to 30 cm deep. The entrance is through a short narrow neck at the top.

The male does most of the drilling. He spends nearly half of the daylight hours each day working on the hole in average sessions of about 20 minutes, resting and feeding in between. First he chisels out the passage, making it just wide enough for himself and his mate to squeeze through. Laboriously he taps and digs out the walls of the cavity, widening and deepening the room inside and throwing the loose chips out over his shoulder. When the hole is deep enough to allow him to turn around inside, he brings the chips out in his bill and scatters them with a shake of the head. After that, he usually sleeps in the cavity at night.

The female occupies herself flying around, feeding, and chasing intruders. When the nest hole nears completion, she becomes more interested in it and begins to work on it diligently. The two devote most of their free time to courtship involving calling and drumming, pursuits, and displays.

The female Downy Woodpecker usually lays four or five white eggs and occasionally six or seven. During the egg-laying, the male and the female take turns guarding the nest by sitting in the doorway.

When the birds begin incubating, or warming, the eggs, they take turns sitting on them during the day in shifts lasting from 15 to 30 minutes. Most changeovers take place at the nest. At night the male remains on the eggs alone while the female sleeps elsewhere. In this manner, the eggs are covered nearly all of the time during the Downy Woodpeckers' 12-day incubation period.

When the young woodpeckers hatch, which occurs in Canada from early May to July, depending on the part of the country, they are tiny helpless creatures, almost naked, sprawled at the bottom of the cavity. They weigh about 1.6 g, a weight that may more than double in the

first day. For a few days the parents warm the nestlings as they did the eggs and occasionally bring them small insects for food.

As the nestlings grow, the parents gradually stop brooding, or keeping them warm, and they spend more time collecting food for their young. When the parent arrives at the nest with food in its bill, there is a swell in the nestlings' chirping noises. The parent dives headfirst into the cavity and touches the corner of a nestling's mouth with its beak. As the mouth springs open, the parent pushes the meal down the nestling's throat. And while the nestling subsides, the parent picks up a fecal sac, or dropping, and flies away with it.

In this way, the nestlings are fed and their nest is kept clean until they are 17 or 18 days old, when they are almost fully grown. They look like their parents, except that the crowns of the young males are tinted red or rust-red or pinkish, and those of the females are striped or dotted with white. The young ones are now able to crawl up the walls of the cavity and take turns sitting in the doorway, looking out. To meet the nestlings' increasing demands for food, the parents bring large meals about every three minutes. Each of four nestlings is therefore fed four or five times an hour.

As the time approaches for the young to leave the nest the parents slow down the feedings, making the nestlings livelier and hungrier. The nestling in the doorway pops in and out with great vigour and calls loudly, but it is in no hurry to leave the nest. Almost a day passes before the fledgling, now as large as its parents and spotlessly clean, pops out far enough to spread its untried wings. Its first flight is usually to the nearest tree, where it often remains motionless for about an hour.

When the fledglings are all out, they hide among the green leaves in the tall trees and call for the parents to come and feed them. Within a week they follow their parents in search of food. The parents also continue to feed them, bringing them such things as fat grubs, often as big as the fledglings' own heads. At the age of three or four weeks the young birds are fully capable of looking after themselves. However, it is at this stage in

the life cycle that mortality is greatest, when the young are out of the nest and no longer protected by the vigilance of their parents.

The adult birds begin to moult their worn and dirty plumage while the young are still in the nest. The strong, central pair of tail feathers is moulted, or shed and replaced, only after all the other tail feathers have been replaced. This ensures that the woodpecker's climbing ability is not hampered during the moulting period. The complete moult takes about two months, during which time each bird keeps much to itself, resting and feeding. When the moult is over in September, the Downy Woodpecker emerges with the white part of its fresh winter plumage showing a faintly yellow tinge that eventually is lost by wear.

The young Downy Woodpeckers also shed their juvenile plumages. Their moult starts in the summer and usually ends in full adult plumage by late fall. Their crowns are jet black, and at the back of the head the young males wear the bright red spot of the adult.

Conservation

The Downy Woodpecker's predators include the American Kestrel, the Sharp-shinned Hawk, and the Cooper's Hawk. All of these birds can capture Downys while the woodpeckers are flying. The woodpecker's first response to danger is to use a tree trunk or branch as a shield. Many a Downy Woodpecker has saved itself from the grasping talons of a hawk by dodging swiftly sideways behind the trunk of a tree.

Black rat snakes often prey on Downy eggs and nestlings, as do flying, red, and eastern grey squirrels. Nestlings raised in holes are, of course, much safer than those in open nests. The narrow entrance to the Downy Woodpecker's nest, hewn to size, protects both the adults and the young from practically all predators except snakes. Even a squirrel, scratching and gnawing at the soft wood to get at the fledglings within, has a difficult time slipping past the watchful defender sitting in the passageway, its awl-like beak at the ready.

Some forest thinning is beneficial for the Downy Woodpecker, which does well in early second-growth forests, where there are more open stands of trees than in older forests. And while extensive forest clearing eliminates habitat for the Downy Woodpecker, the bird has survived in areas that have been cleared for agriculture. In these areas, the replacement of wooden fence posts—where the Downy Woodpecker bores roosts, or resting places—with metal posts seems to be the main concern. Overall, Downy Woodpecker populations are stable in North America, and in Canada, the numbers of the birds has even increased in the last 20 to 30 years.

Resources

Online resources

Cornell Laboratory of Ornithology:
<http://birds.cornell.edu/bow/dowwp/>

Environment Canada Wildspace:
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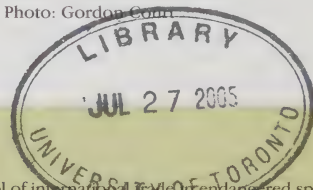
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Catalogue number CW69-4/27-2003E
ISBN 0-662-34279-8
Text: Louise de Kiriline Lawrence
Revision: K. Dickson, 1988;
C.M. Downes, 2003
Editing: Maureen Kavanagh, 2005
Photo: Gordon Goss



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HINTERLAND WHO'S WHO

ENVIRONMENT CANADA'S PROTECTED AREAS NETWORK



Photo: Garry Trottier (CWS)

The Great Plain of the Koukdjuak on Baffin Island (part of which is protected as Dewey Soper Migratory Bird Sanctuary) shelters the largest goose colony in the world.

There are 51 NWAs and 92 MBSSs. Some of these NWAs and MBSSs extend beyond land, incorporating freshwater and marine areas, thereby helping to safeguard 1.5 million hectares of Canada's aquatic habitat. In addition, sites are being considered as MWAs in offshore and coastal areas where plants, animals, and ecosystems will be protected.

Why are some areas set aside for wildlife?

Canada is renowned as a land of magnificent natural scenery and a wealth of wildlife. What many people may not know, however, is that some of the country's most important sites for wildlife and coincidentally, some of its most scenic sites, are protected spaces for wildlife.

Environment Canada's Canadian Wildlife Service administers a network of protected areas, which protects an estimated 11.8 million hectares of wildlife habitat, an area more than twice the size of Nova Scotia.

The components of the network are National Wildlife Areas (NWAs), Migratory Bird Sanctuaries (MBSSs), and Marine Wildlife Areas (MWAs). These sites contain a wide diversity of habitat of national and international importance.

For example, approximately 75 percent of the world's population of Semipalmated Sandpipers carpets the beaches and mudflats of Shepody National Wildlife Area in the Bay of Fundy over the six-to-eight-week southward migratory period each year. At some sites, single flocks can attain numbers of 250 000 birds or more and move as one body, wheeling in the sky, skimming over the water, and lighting on the shore in such density that the beaches seem alive with moving pebbles.

Why have these areas been set aside? Each wild plant and animal species needs habitat—a particular location with specific characteristics, including an appropriate climate and available food and shelter, where wildlife may live. Animals that migrate, such as caribou, monarch butterflies, and many birds, need several habitats. They may breed in one habitat during summer, winter in another, and cross a number of other habitats as they undertake seasonal migrations.

To preserve abundant and diverse wildlife populations in Canada, we need to ensure suitable habitats exist. This is the purpose of Environment Canada's protected areas. The Canadian Wildlife Service identifies wildlife habitat of national ecological

importance whose loss would have a direct impact on the Canadian population of one or more wild species, and it works closely with many groups to ensure that such areas are protected as NWAs, MBSS, or MWAs.

How are protected areas established?

North America's oldest waterfowl sanctuary at Last Mountain Lake in Saskatchewan was set aside by Parliament in 1887 to protect breeding grounds for "Wild Fowl." In 1916, Canada and the United States signed the Migratory Birds Convention which obliged both countries to preserve migratory birds and protect them from indiscriminate slaughter. Canada implemented the convention through the Migratory Birds Convention Act of 1917 under which Last Mountain Lake became an MBS.

The Migratory Birds Convention Act and the MBSS established under that act protect migratory birds against physical disturbance and hunting, which was the main threat in the early part of the 20th century, but they do not protect habitat or species of wildlife other than migratory birds. By the 1960s and 1970s, significant wildlife habitats, particularly wetlands, were being lost at an alarming rate. The Canada Wildlife Act (1973) was passed to authorize the establishment of sites known as National Wildlife Areas in which migratory birds and other wildlife, particularly species at risk and their habitat, could receive protection. In 1994, the act was amended to include the creation of MWAs.

The Species at Risk Act (SARA), which was proclaimed in 2003, expands the scope for



applying NWA and MWA status to protect wildlife habitat. SARA aims to protect species recognized as being at risk nationally or regionally, as well as their habitat. SARA also amends the Canada Wildlife Act to allow the Minister of the Environment to give other federal ministers the power to name and manage NWAs and MWAs.

Usually, CWS staff nominate a potential protected area, although members of the scientific community, provincial biologists, conservation groups, Aboriginal groups, and private citizens have all made proposals that have been adopted.

To be considered for designation as an NWA or an MWA, a site must contain "nationally significant" habitat for migratory birds, support wildlife or ecosystems at risk, or represent a rare or unusual wildlife habitat or biogeographic region. Both NWAs and MWAs must be comprised of land or waters under federal jurisdiction.

Migratory Bird Sanctuaries

MBSS cover approximately 11.2 million hectares. The largest federally designated area to protect migratory birds in Canada is the Queen Maud Gulf MBS, which was created in 1961 on the northern mainland tundra of Nunavut. Over 90 percent of the world's population of a small white goose, called Ross's Goose, nest there. The Queen Maud lowlands shelter the largest variety of geese of any nesting area in North America, including Ross's Geese, Lesser Snow Geese, Canada Geese, White-fronted

Geese, Atlantic Brant, and Black Brant, as well as Tundra Swans.

The Migratory Bird Sanctuary Regulations prohibit disturbance of migratory birds, their eggs, and their nests within an MBS. The regulations also prohibit disturbance of migratory birds' habitat when MBSS are established on federal Crown land. In most MBSS, visitors must not carry firearms or allow their pets to run at large. However, in northern Canada Aboriginal people have the right to carry firearms in MBSS for traditional hunting and trapping purposes.

Migratory Bird Sanctuaries protect the habitat of thousands of birds

There are several very large MBSS in the Northwest Territories and Nunavut, but the sizes of the other MBSS vary greatly. In British Columbia, the Vaseaux Lake MBS, 282 hectares of lake and shoreline in the Okanagan Valley, was established to protect the endangered Trumpeter Swans that stop there during their autumn migration. The smallest MBS, the 0.08-hectare Christie Islet, is in Howe Sound, north of Vancouver in British Columbia. It is the only location in the Vancouver area where large numbers of seabirds nest. Îles Sainte-Marie MBS (4 100 hectares) on the north shore of the Gulf of St. Lawrence is an important nesting site for thousands of seabirds, among them Common Murres and Razorbills.

Management includes monitoring wildlife, maintaining and improving wildlife habitat, periodic inspections, enforcement of hunting prohibitions and regulations, and the maintenance of signs. Research is also an important function of the protected areas; CWS staff carry out and coordinate research at some sites.

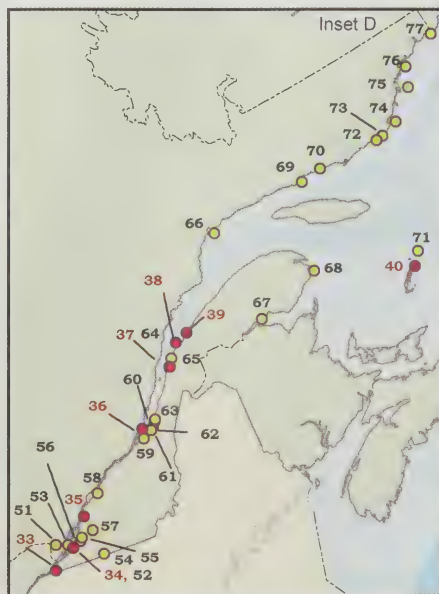
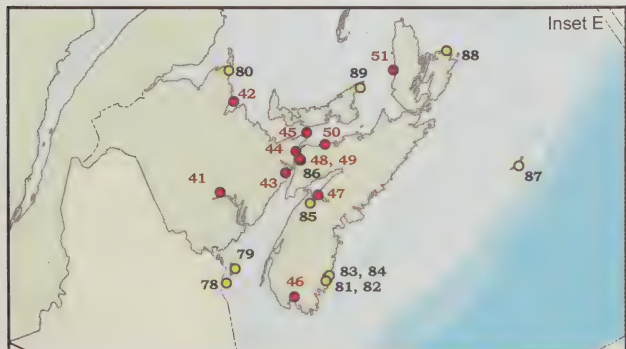
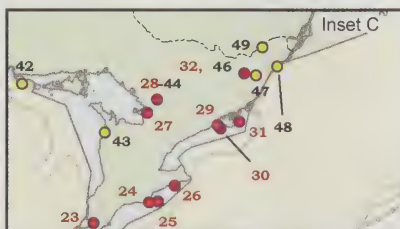
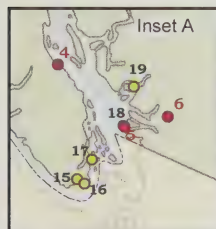
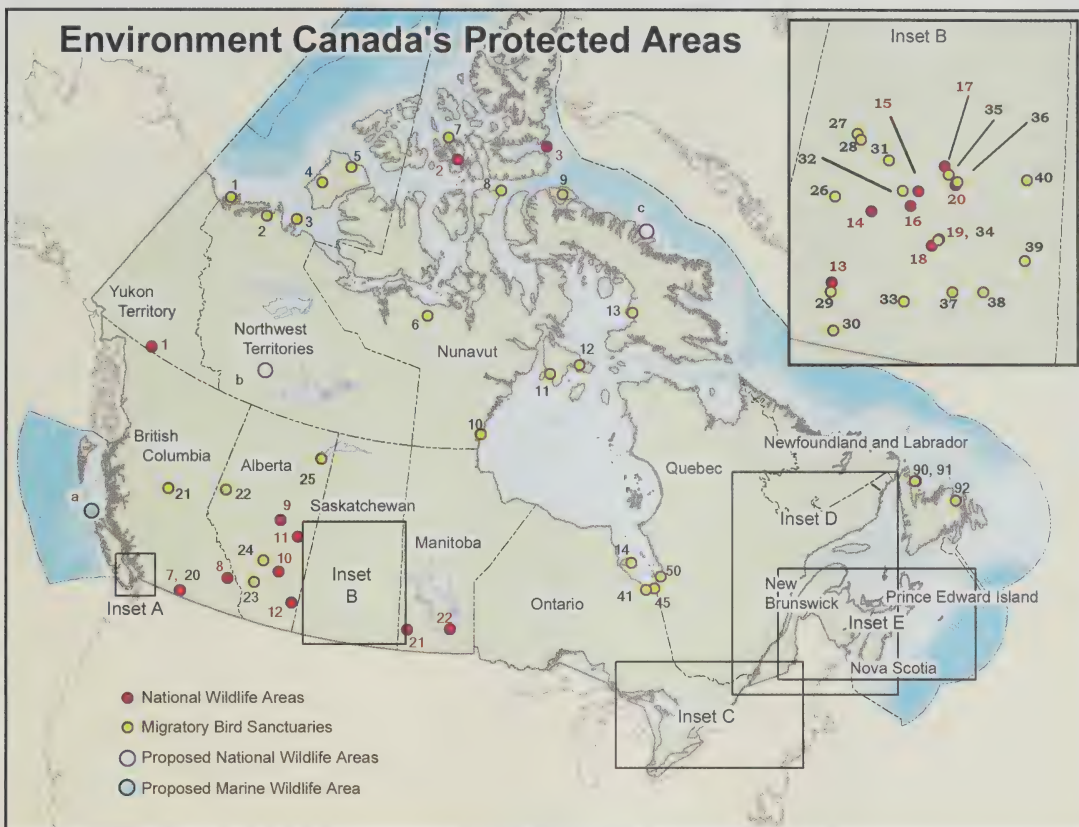
National Wildlife Areas and Marine Wildlife Areas

The purpose of NWAs and MWAs is to conserve essential habitats for migratory birds and other wildlife species, especially endangered wildlife. The NWAs protect approximately 529 000 hectares of habitat.

Marine Wildlife Area: A first in Canada

The Scott Islands archipelago in British Columbia, a proposed Marine Wildlife Area, will protect more than two million seabirds that nest there each year, including 55 percent of the world population of Cassin's Auklets. The site is already an internationally recognized Important Bird Area.

Environment Canada's Protected Areas



National Wildlife Areas

No.	Name and area (hectares)
Yukon Territory	
1	Nisutlin River Delta - 5 488
Nunavut	
2	Polar Bear Pass (R) - 267 500
3	Nirjutiqavvik (Coburg Island) - 165 000
British Columbia	
4	Qualicum - 82
5	*Alaksen (R) - 299
6	Widgeon Valley - 125
7	*Vaseux-Bighorn - 812
8	Columbia - 1 001
Alberta	
9	Meanook - 214
10	Spiers Lake - 64.7
11	Blue Quills - 96.8
12	CFB Suffield - 45 807
Saskatchewan	
13	Webb - 427
14	Prairie - 2 938
15	St. Denis - 361
16	Bradwell - 123
17	Tway - 96
18	Stalwart - 1 525
19	*Last Mountain Lake (R) - 16 898
20	*Raven Island - 94
Manitoba	
21	Pope - 31
22	Rockwood - 30
Ontario	
23	St. Clair (R) - 289
24	Big Creek - 802
25	Long Point (R) - 3 250
26	Mohawk Island - 4
27	Wye Marsh - 47
28	*Eleanor Island - 0.6
29	Wellers Bay - 40
30	Scotch Bonnet Island - 0.9
31	Prince Edward Point - 246
32	*Mississippi Lake - 235
Quebec	
33	Lac Saint-François (R) - 1 446
34	*Îles de la Paix - 120
35	Îles de Contrecoeur - 312
36	Cap Tourmente (R) - 2 399
37	*Baie de l'Isle-Verte (R) - 797
38	Îles de l'Estuaire - 409
39	Pointe-au-Père - 23.3
40	Pointe de l'Est - 974
New Brunswick	
41	Portobello Creek - 1 990
42	Portage Island - 451
43	Shepody (R) - 979
44	Tintamarre - 1 990
45	Cape Jourmain - 621
Nova Scotia	
46	Sand Pond - 532.4
47	Boot Island (R) - 144
48	John Lusby (R) - 1 020
49	*Chignecto (R) - 409.6
50	Wallace Bay - 585
51	Sea Wolf Island - 40.5

* Overlaps with or contains another National Wildlife Area or a Migratory Bird Sanctuary
(R) Overlap with or contains a Ramsar site

Migratory Bird Sanctuaries

No.	Name and area (hectares)	No.	Name and area (hectares)
Northwest Territories		Quebec	
1	Kendall Island - 60 900	50	†Boatswain Bay - 17 900
2	Anderson River Delta - 102 500	51	Île Carillon - 426
3	Cape Parry - 200	52	*Îles de la Paix - 1 115
4	Banks Island No. 1 - 1 999 700	53	Senneville - 569
5	Banks Island No. 2 - 17 000	54	Philipsburg - 525
Nunavut		55	Île aux Hérons - 622
6	Queen Maud Gulf (R) - 6 176 500	56	Île de la Cuvée - 17
7	Seymour Island - 2 800	57	Mont Saint-Hilaire - 955
8	Prince Leopold Island - 31 100	58	Nicolet (R) - 2 835
9	Bylot Island - 1 263 500	59	Saint-Vallier - 405
10	McConnell River (R) - 33 400	60	Trois-Saumons - 222
11	Harry Gibbons - 122 400	61	Montmagny - 80
12	East Bay (R) - 113 800	62	Cap-Saint-Ignace - 133
13	Dewey Soper (R) - 793 000	63	L'Islet - 64
14	Akimiski Island - 336 700	64	*L'Isle-Verte - 303
British Columbia		65	Île aux Basques - 933
15	Esquimalt Lagoon - 129.6	66	Île du Corossol - 413
16	Victoria Harbour - 1 700	67	Saint-Omer - 64.6
17	Shoal Harbour - 150	68	Île Bonaventure et du Rocher Percé - 1 360
18	*George C. Reifel (R) - 648	69	Betchouane - 462
19	Christie Islet - 0.08	70	Watshishou - 11 320
20	*Vaseux Lake - 282	71	Rochers-aux-Oiseaux - 625
21	Nechako River - 180	72	Île à la Brume - 4 320
Alberta		73	Baie des Loups - 3 550
22	Saskatoon Lake - 1 135	74	Îles Sainte-Marie - 4 100
23	Inglewood - 1 600	75	Gros Mécatina - 2 310
24	Red Deer - 130	76	Saint-Augustin - 5 570
25	Richardson Lake - 12 705	77	Baie de Brador - 538
Saskatchewan		New Brunswick	
26	Opuntia Lake - 1 395	78	Machias Seal Island - 622
27	Murray Lake - 1 165	79	Grand Manan - 250
28	Scent Grass Lake - 633	80	Inkerman - 15.1
29	Duncairn Reservoir - 1 546	Nova Scotia	
30	Val Marie Reservoir - 505	81	Haley Lake - 100
31	Redberry Lake - 6 395	82	Sable River - 260
32	Sutherland - 130	83	Port Hebert - 350
33	Old Wives Lake - 26 060	84	Port Joli - 280
34	*Last Mountain Lake (R) - 4 855	85	Kentville - 200
35	Basin and Middle Lakes - 8 720	86	*Amherst Point (R) - 429
36	*Lenore Lake - 8 830	87	Sable Island - 2 350
37	Wascana Lake - 104	88	Big Glace Bay Lake - 240
38	Indian Head - 32	Prince Edward Island	
39	Upper Rousay Lake - 518	89	Black Pond - 130
40	Neely Lake - 809	Newfoundland and Labrador	
Ontario		90	Shepherd Island - 16
41	Moose River (R) - 1 457	91	Île aux Canes - 150
42	St. Joseph's Island - 940	92	Terra Nova - 870
43	Chantry Island - 81		
44	*Eleanor Island - 0.6		
45	†Hannah Bay (R) - 29 500		
46	*Mississippi Lake - 430		
47	Rideau - 809.4		
48	Upper Canada - 2 663		
49	Beckett Creek - 103		

* Overlaps with or contains another Migratory Bird Sanctuary or a National Wildlife Area
(R) Overlaps with or contains a Ramsar site
† Located partly in Nunavut

Proposed Marine Wildlife Area

- a Scott Islands - 144 000 hectares (BC)

Proposed National Wildlife Areas

- b Edzhzhie - 2 500 000 hectares (NT)
c Igaliktuq (Isabella Bay) - 551 500 hectares (NU)

CWS prepares a management plan for each NWA with the involvement of the local communities. The plan specifies activities that are generally allowed and identifies additional activities to be allowed under permit. For example, traditional uses such as berry picking, canoeing, hunting, fishing, and trapping may be generally allowed, while oil drilling, livestock grazing, or haying could be allowed with strict limitations under a yearly permit. Management plans may also specify how and where to make habitat improvements. Examples include planting native vegetation to provide food and cover and make the landscape more attractive to birds and other wildlife. Management plans must respect Aboriginal rights and practices specified under land claims agreements.

Under the Canada Wildlife Act, public education and research are also goals of NWAs. In most NWAs there are some opportunities for public use. In others, research and protection of sensitive natural resources take precedence. For example, access to Scotch Bonnet Island NWA in Lake Ontario is restricted because the island is used for long-term studies of the effects that environmental contamination of the Great Lakes is having on wild birds. All these education and research activities are regulated to prevent declines in wildlife populations and deterioration of habitats.

National Wildlife Areas: Wildlands for Wildlife

NWAs protect a variety of important habitat areas across Canada. The wetlands and agricultural and wooded uplands of the Alaksen NWA in the Fraser River estuary in British Columbia are an internationally important migration stopover and wintering area for a huge number and variety of migrating birds, such as Lesser Snow Geese, ducks, and shorebirds. Pointe de l'Est NWA in the Gulf of St. Lawrence is one of the few remaining nesting sites in Quebec for the Piping Plover, which is an endangered species in Canada. The bowhead whales in the proposed MWA site of Igaliktuq on the east coast of Baffin Island are part of the endangered arctic population of bowheads.

Canadian Forces Base Suffield National Wildlife Area

The Minister of Defence manages as an NWA a section of the Canadian Forces Base Suffield training area in southern Alberta. This area, which contains sand dune and mixed prairie habitat, is home to 14 species at risk in Canada, including the Burrowing Owl and the Ferruginous Hawk.

The Canada Wildlife Act can also be used to designate protected areas that would highlight the long-standing interaction of Aboriginal peoples with Canada's natural spaces. The primary reason for establishing these areas would be the maintenance of their ecological value and biodiversity. The history of use and cultural value of these areas to Aboriginal peoples and the role that Aboriginal people would play in managing the areas would also be considerations.

International recognition

Many NWAs and MBSSs have also been accorded international recognition. The Convention on Wetlands of International Importance, more commonly known as the Ramsar Convention, identifies and recognizes wetlands of international importance. Canada has 36 such sites, of which 17 are NWAs and MBSSs.

The Western Hemisphere Shorebird Reserve Network links sites in different countries of North, Central, and South America that are essential to large numbers of shorebirds as they complete their yearly migrations of thousands of kilometres. Of the five sites in Canada, three include NWAs and MBSSs.

The Important Bird Areas (IBA) Program is a global effort of BirdLife International to identify and protect the most critical habitats for the world's birds. Of the 597 IBAs that have been identified in Canada as being of worldwide, continental, or national significance, 80 are located partially or wholly in NWAs or MBSSs.

The international UNESCO biosphere reserve program aims to conserve

biodiversity while taking human development into account. Four of the 12 biosphere reserves in Canada are part of CWS's protected areas network.

Can the public use Environment Canada's protected areas?

Wildlife conservation is the primary purpose of Environment Canada's protected areas, but most sites permit public access and some offer visitor facilities, and limited activities and services: Alaksen NWA in British Columbia; Cap Tourmente NWA in Quebec; St. Clair NWA in southwestern Ontario; Mary's Point Unit of Shepody NWA, Cape Jourimain NWA, and Machias Seal Island MBS in New Brunswick; Chignecto NWA in Nova Scotia; and Last Mountain Lake NWA and MBS in Saskatchewan provide special facilities to view wildlife. In these protected areas, there may be exhibits, trails, brochures, and viewing stands to help visitors understand their surroundings. Locally published notices inform people about the activities that are generally permitted in protected areas. In some cases, special permits are required to engage in certain activities.

However, most NWAs and almost all MBSSs are unstaffed and do not have on-site visitor services. In some cases, CWS may prohibit visitation during critical periods, such as nesting and moulting. Acts and regulations related to protected areas are available on the CWS Web site.

To find out more about Environment Canada's protected areas consult the following:

Canadian Wildlife Service
Environment Canada
Ottawa, Ontario K1A 0H3
Phone: (819) 997-1095
E-mail: cws-scfc@ec.gc.ca
Web site: www.cws-scfc.ec.gc.ca

Environment Canada's Protected Areas Network online on the Hinterland Who's Who Web site at www.hww.ca/hww2.asp?pid=0&cid=4&id=231

Resources

Online resources

Birdlife International: www.birdlife.net

Canadian Wildlife Service: www.cws-scf.ec.gc.ca

Environment Canada—Species at Risk: www.speciesatrisk.gc.ca

Fisheries and Oceans Canada: www.dfo-mpo.gc.ca/canwaters-eauxcan

Parks Canada: www.parkscanada.gc.ca

Ramsar Convention on Wetlands: www.ramsar.org

UNESCO Biosphere Reserves: www.unesco.org/mab

Western Hemisphere Shorebird Reserve Network: www.manomet.org/WHSRN/

Print resources

Canadian Nature Federation. 2002. Conserving wildlife on a shoestring budget: Opportunities and challenges for Canada's National Wildlife Areas, Migratory Bird Sanctuaries and Marine Wildlife Areas, Ottawa. (Also available at www.cnf.ca)

Canadian Wildlife Service. 2002. Habitat Stewardship Program for species at risk. Ottawa. (Also available at www.cws-scf.ec.gc.ca/hsp-pih)

Wildlife Habitat Canada. 2001. The status of wildlife habitats in Canada 2001. Ottawa.

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Catalogue no. CW69-4/90-2004E
ISBN 0-662-34252-6
Text: S.P. Burns and C.L. Warren
Revision: 1996; S. Virc and A. Mailloux, 2003
Editing: M. Kavanagh, 2003

Cover photo: South Saskatchewan River Valley, Canadian Forces Base (CFB) Suffield National Wildlife Area

The Canadian Wildlife Service

The Canadian Wildlife Service of Environment Canada handles wildlife matters that are the responsibility of the Canadian government. These include protection and management of migratory birds as well as nationally significant wildlife habitat. Other responsibilities

For more information about the Canadian Wildlife Service or its other publications, please contact:

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E-mail: cws-scf@ec.gc.ca

are species at risk, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

Visit *Hinterland Who's Who* on the Web at www.hww.ca.

Hinterland Who's Who is a collaboration between the Canadian Wildlife Service and the Canadian Wildlife Federation.



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HINTERLAND WHO'S WHO

GREAT BLUE HERON



This bird

- is the largest heron in Canada
- has elaborate courtship and other displays
- often nests in colonies
- shares nurturing duties: both the male and the female incubate the eggs and feed the young
- is a patient hunter, often waiting motionless for several minutes before catching its prey

Description

The Great Blue Heron *Ardea herodias* is the largest heron in Canada. Adults stand over 1 m high with their necks outstretched, and they weigh around 2.5 kg.

This bird gives the general impression of being tall and thin: its wings, neck, bill, and legs are long. The long limbs dictate the heron's movements: it flies with deep, slow wing beats, and on land, or in the water, it walks erect with long strides. In flight, the neck is doubled back, the head resting against the shoulders, and the long legs held straight behind.

Flight silhouettes



The top of the adult's head is white with a black stripe on each side extending from the yellow eyes to slender black plumes at the back of the head. Its back is greyish blue, and its breast is white streaked with black. Breeding herons have long plumes on their breasts, flanks, and backs. The sexes look much alike, but the males are usually bigger than the females.

From birth to two years, Great Blue Herons moult, or replace old feathers with new, four times. During the first year, juveniles have grey crowns and grey wings flecked with brown, and they lack plumes. Adult Great Blue Herons show brighter colours during the breeding season, moult some plumes in summer, and change to duller colours in winter.

Great Blue Herons live long lives, some as long as 17 years.

Signs and sounds

The Great Blue Heron is generally silent, but it does have a repertoire of noises. It gives a *fraunk* sound at breeding colonies when alarmed, a *gooo* call at the end of one of its courtship displays, an occasional *ee* call when flying, and sometimes a series of clucks when foraging. The heron also utters a *rob-rob-rob* sound when it approaches the nest, perhaps to alert its mate to its arrival.

Part of the males' courtship displays are loud bill snaps. Females snap bills when they are approaching unmated males and after they have formed a breeding pair. It is also common for paired birds to engage in a rapid side-to-side tapping of each other's bill tips.

Habitat and habits

Great Blue Herons forage in marine coastal environments and in freshwater habitats, but nest on islands or in wooded swamps, where few mammals or snakes can prey on them. The birds sometimes nest alone, but often do so in colonies consisting of a dozen to several hundred pairs. Scientists do not know precisely how herons choose whether to be sociable. It seems that advantages to colonial behaviour include better defense of nests and greater chance of discovering mobile schools of fish: once

one heron finds a good foraging spot, others may follow it to the same location.

Unique characteristics

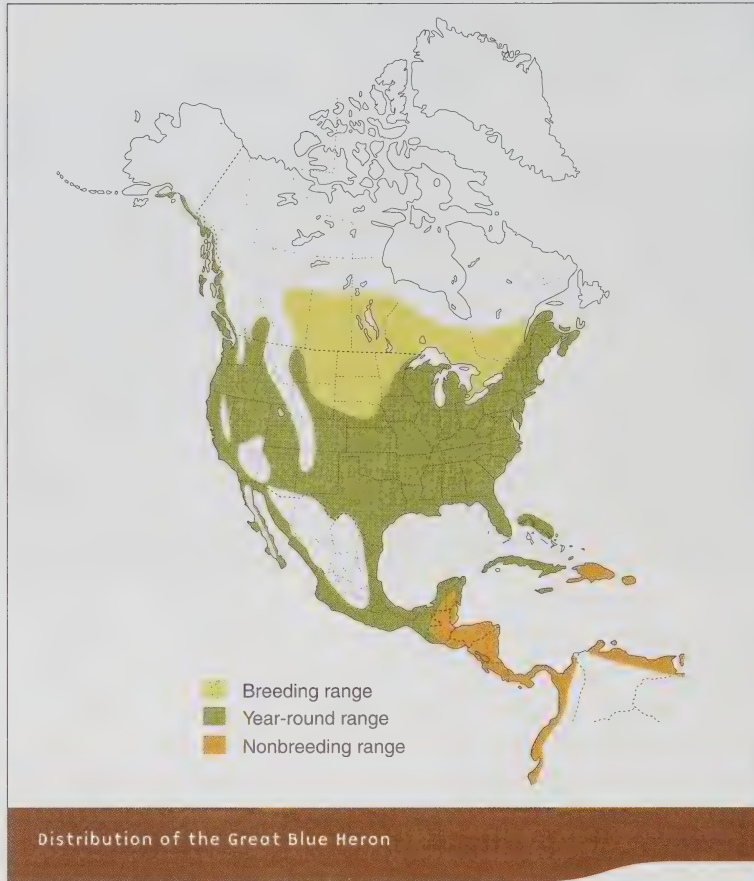
The Great Blue Heron has an array of displays. Some of them are seen on the foraging grounds, as, for example, when two herons approach each other, each extending its neck fully and tilting its head over its back, with the wings partly opened and the body plumes erect. In others, the herons sleek their plumage, extend their necks forward, and tilt their heads from side to side so that they may look upwards, a posture they often use when predators and herons fly over the foraging grounds. Sometimes, a heron will thrust its beak at an opponent, and during some displays, "bill duels" erupt when opponents try to grab each other's head.

Another set of displays occurs when a mate returns to the nest. The arriving bird often greets the mate using a particular call, and the bird on the nest responds with one of a number of displays. Sometimes, the male brings sticks to the female on the nest. The female performs a display and takes the sticks, and the male then taps the female's bill from side to side while she places the sticks in the nest.

Range

The Great Blue Heron has the widest distribution in Canada of all herons: it ranges from the Maritime provinces in the east across southern Canada to the Pacific Ocean, and north along the entire length of the British Columbia Pacific coast to Alaska's Prince William Sound in the west. While it breeds in all provinces except Newfoundland and Labrador, this bird spends the winter in Canada only on the British Columbia coast and in parts of the Maritime provinces. Most birds move south for the winter, and banded birds from Canada have been found in Mexico, Honduras, and Cuba. Colonies of Great Blue Herons are also found in Colombia, Venezuela, and Ecuador's Galapagos Islands.

Great Blue Herons migrate alone or in groups of three to 12 and sometimes up to 100. They travel day and night. Spring migrants return to most Canadian locations in April. Some fly north in summer to arctic Alaska, southern



Yukon, and northern Manitoba, Ontario, and Quebec. They migrate south from mid-September to late October.

Feeding

The Great Blue Heron feeds mostly in calm freshwater and along seacoasts. Occasionally, it finds its food in surf and in fields.

Its main food is small fish less than half the length of its bill, or under 65 mm long. On occasion, it also eats shellfish, insects, rodents, amphibians (mostly frogs), reptiles, and small birds.

The Great Blue Heron has two principal fishing techniques. The first consists of standing motionless, its neck extended at an angle of about 45 degrees to the water's surface. Only the head and eyes move to locate the prey. If no fish comes

within range after a few minutes, the heron gradually moves a short distance away and takes up a similar position. When a potential meal comes close enough, the heron slowly folds its neck back and moves one leg in the direction of the prey. Suddenly, its entire body unbends, its head plunges into the water, it catches the prey in its bill, and it swallows it outside the water, using a deft movement of the head to drop the prey headfirst into its gullet.

Using the second technique, the heron slowly wades around in about 15 to 25 cm of water until it drives a fish out from a hiding place. The heron then stops and slowly stretches its neck. When the prey is within range, the bird uncoils its body and thrusts its head into the water in pursuit. When it has eaten the catch, the heron resumes its walk. Should the bird fail to find sufficient fish

in an area, it flies a short distance away and resumes fishing.

When captured prey is too large to be gulped down immediately or has dangerous spines, the heron drops the prey back into the water and grabs hold of it repeatedly and violently with its beak until the catch is dazed or the spines snap. Then it can be swallowed more easily. Sometimes two fish are caught simultaneously.

Other techniques are observed, but more rarely: for example, Great Blue Herons in flight sometimes dive underwater to catch fish; others hover over the water and submerge their heads to catch fish; and some swim in deep water and feed on fish found near the surface.

Breeding

In the spring, males and females reach the nesting grounds at about the same time, as soon as local water courses have thawed, in late February in western Canada and late March in eastern Canada. The nesting area is generally located in woodlands that are within a few kilometres of the birds' main feeding area and relatively inaccessible to humans and land predators. Males choose the nesting spot, usually settling where there are nests from former years. Each male then defends his territory in the tree where he plans to build a new nest or restore an old one. From that site, males put on grand displays and shriek loudly when females approach them. The birds first mate at two years of age, and they choose new mates each year. They mate almost immediately upon arrival.

The building of the nest soon follows. The male gathers nest-building materials around the nest site, from live or dead trees, from neighbouring nests, or along the ground, and the female works them into the nest. Recently built nests look like delicate platforms of interlaced dry branches, and older nests are bulky structures of different sizes. Usually, nests are about 1 m in diameter and have a central cavity 10 cm deep with a diameter of 30 cm. The herons sometimes line this internal cavity with twigs, moss, lichens, or conifer needles. Ordinarily, a pair takes less than a week to build a nest solid enough for eggs to

be laid and incubated. Twigs are added mostly before the eggs are laid, but also when they hatch.

In Canada, most herons lay from three to five eggs in April. Incubation, or warming of the eggs, starts with the laying of the first or second egg and lasts about 28 days. It is shared by both partners: the male incubates during the day and the female at night.

Eggs usually hatch during the time when food is most abundant in the area. The parents immediately begin to feed their young, and keep them warm, or brood them, continually for the first week. The adults brood less after that, but for the next week or two, one adult remains at the nest almost without break: during the day, the male watches the nest while the female hunts for food; at night the roles are reversed. By about the third or fourth week, both parents begin to leave the chicks unguarded to search for food in the neighbourhood. After the first month, the pair spends most of its time outside the colony, returning only to feed the young and stand watch for short periods.

Feeding is a raucous affair. An adult arriving at the heronry usually gives a dull guttural cry. The young cry constantly and grab at each others' bills. The adult rarely flies straight to them, perching instead a few metres from the nest. After about five minutes, the adult goes to the nest and regurgitates predigested food. The oldest and largest chicks take the lion's share by grasping the adult's bill and catching the food before it reaches the nest floor.

If the food supply is not sufficient to satisfy the growing appetites of all the nestlings, only the strongest will survive. Puny members of the brood weaken progressively and often end up falling from the nest, pushed aside by others eager for space to stretch their wings. On the ground, they are doomed to starve, because the parents will not feed young outside the nest.

Young herons develop rapidly. At two weeks, between periods of sleep, they may clean their plumage, stand upright with their wings half-opened, or vibrate their elastic throat membranes in order to cool themselves. At six weeks, they no

longer sleep much during the parents' absence; instead, they prepare for their initial flight. They walk along the branches surrounding the nest, jump while beating their wings, or grasp a branch with their claws and try to raise it with the power of their wing beats.

At eight weeks of age, the young fly clumsily from one tree to another, but always return to the nest to be fed. Often a young bird will go to the wrong nest, which leads to fighting between the occupants and the intruder. The intruder is likely to be more developed than the others and thus manages to stay in the nest, sometimes after pushing one of its inhabitants to the ground. In such cases, the intruder is eventually chased off by a returning adult. At about 10 weeks the young herons leave their nest for good and are independent of their parents. From one to four chicks are raised, with two or three being most common.

Conservation

Adult Great Blue Herons have few natural enemies. Eagles occasionally attack them, and crows, ravens, gulls, birds of prey, and raccoons prey upon the eggs and young; mortality of the young is high, but often for reasons other than predation.

Heavy rains and cold weather at the time of hatching take a substantial toll. Also, when food is scarce, the weakest young birds often do without and waste away. Pesticides are suspected of causing reproductive failures and deaths, although data obtained up to this time suggest that toxic chemicals have not caused any decline in overall population levels.

In the past, hunting caused many heron deaths. Today, a frequent reason for nesting failures is disturbance by eagles and humans; herons are particularly sensitive to disturbance while nesting. Scientists suggest that, as a general rule, there should be no development within 300 m of the edge of a heron colony and no disturbance in or near colonies from March to August.

Draining of marshes and destruction of other favourite haunts is a serious threat to the Great Blue Heron's survival. The number of herons breeding in an area is

directly related to the amount of feeding habitat available to them.

The Committee on the Status of Endangered Wildlife in Canada has assessed the coastal "Pacific" subspecies of Great Blue Heron as a species of special concern.

Overall, the Great Blue Heron population is healthy. Scientists estimate that there are tens of thousands of Great Blue Herons in Canada.

Resources

Online resources

Canadian Wildlife Service, Species at Risk: www.speciesatrisk.ca

EcoKids Online:

ecokids.earthday.ca/pub/eco_info/topics/water/heron/index.cfm

Heron Working Group:

www.sfu.ca/biology/wildberg/hwg/heronworkgroup.html

Print resources

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Catalogue number CW69-4/104-2003E

ISBN 0-662-34281-X

Text: J.-L. DesGranges

Revision: R. W. Butler, 1990, 2003

Editing: Maureen Kavanagh, 2005

Photo: Tony Beck



The Canadian Wildlife Service

The Canadian Wildlife Service of Environment Canada handles wildlife matters that are the responsibility of the Canadian government. These include protection and management of migratory birds as well as nationally significant wildlife habitat. Other responsibilities

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are species at risk, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

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HINTERLAND WHO'S WHO

GREATER SNOW GOOSE



Photo: Eric Roth (CNS)

This bird

- breeds farther north than most other geese
- can walk 30 km when it is one day old
- can fly as fast as 95 km/h and make nonstop flights of up to 1 000 km
- mates for life
- gathers in great numbers during its migrations; for example, 500 000 geese at a time can be seen in early April at Baie-du-Febvre, Quebec

Description

The adult Greater Snow Goose *Chen caerulescens atlantica* is almost entirely white, except for black primary feathers at the wing tips. Its feet are pinkish, as is its bill, which is also narrow and rather high and equipped with cutting edges that allow the Greater Snow Goose to feed on the roots of plants that grow on muddy banks. These cutting edges form a blackish arc, called a “grinning patch” or “smile,” along each side of the bill on both the upper and lower mandibles. Because the goose constantly digs in the mud in search of food, its head often becomes stained rusty-orange from the traces of iron in the mud.

Young geese have grey plumage with greyish white patterns. Their feet and bills are a dark olive-slate colour. During their first winter, the young gradually lose their grey feathers, which are

replaced by white ones. By the start of their second year, the juveniles are as white as the adults.

The wingspan of an adult Greater Snow Goose can be slightly more than 1.5 m. Adult males may weigh up to 3.5 kg; females are a little lighter. In their first fall, juveniles weigh between 1.5 and 3 kg.

Signs and sounds

The main call of the adult Greater Snow Goose—a loud, nasal *wbouk* or *kowk* or a *kow-luk*, resembling a dog’s bark, which it utters at any time—has earned this goose a reputation as the noisiest of waterfowl. Young birds that have not bred are fairly quiet.

Habitat and habits

During its breeding season, from early June to early September, the Greater Snow Goose lives in the high arctic

tundra near the coast or inland on rolling terrain or in low-lying wet meadows with many grasses and sedges. During the winter along the United States Atlantic coast, it frequents marine inlets and bays, marshes, coastal prairies, and cultivated fields.

The Greater Snow Goose moves very well on land, on the water, and in the air. It is a good walker. On Bylot Island, Nunavut, the world’s largest Greater Snow Goose breeding colony, the distance between the birds’ nesting and breeding sites is more than 30 km. Within a day of hatching, many young geese set off on this trek with their families, reaching their destination within four days. As an adult, a Greater Snow Goose can outrun most predators when it is moulting and cannot fly. It swims well, and while it does not dive for food, it will dive short distances if it is threatened. As for flying, this goose usually travels at about 55 km/h, is capable of reaching speeds of up to 95 km/h, and can make long nonstop flights of up to 1 000 km.

Unique character

The Greater Snow Goose is dimorphic, meaning that it appears in two forms. Most Greater Snow Geese are called light morphs: they are white. Some are called dark morphs, or blue, geese: most of

their feathers are blue-grey. The blue morph, which is quite common in Lesser Snow Geese, is rare in Greater Snow Geese: fewer than 4 percent of Greater Snow Geese are of this blue phase. Blue morph geese tend to mate with blues, and whites with whites.

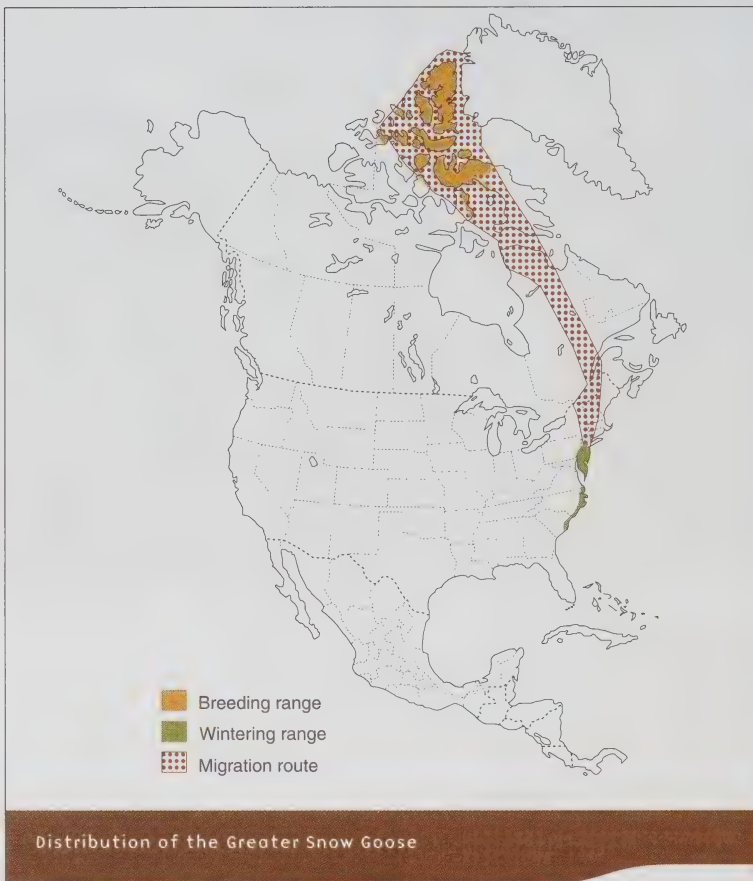
Range

Only one population of Greater Snow Geese exists in the world. It is almost entirely confined to the Atlantic flyway of North America. Greater Snow Geese breed in the Canadian High Arctic, from the Foxe Basin to Alert on northern Ellesmere Island. Some breeding colonies can also be found on the western coast of Greenland. This makes the Greater Snow Goose one of the most northerly breeding geese in the world. It winters along the United States Atlantic coast, from New Jersey to South Carolina, with major concentrations around Delaware and Chesapeake bays.

Greater Snow Geese undertake longer migrations than most other North American geese: they usually travel more than 4 000 km. In spring and fall, they fly in flocks of families and individuals, travelling day and night. The spring flocks are smaller than the autumn ones: between 35 and 400 birds fly together in the spring, whereas more than 1 000 can travel together in the fall.

In Canada, the Greater Snow Goose migration follows a corridor between the eastern seaboard and the eastern Arctic. The spring migration begins in March, and the first geese arrive in the St. Lawrence River area by the first week of April; the last leave on the final stage of their northward journey by May 25. The entire population of 700 000 to 800 000 birds stages, or gathers, in a few localized areas, making their migration a most spectacular event. Striking concentrations of more than 500 000 Greater Snow Geese can be seen in early April at Baie-du-Febvre, on the south shore of Lac Saint-Pierre, between Montréal and Trois-Rivières. Large groups of geese also gather at Cap Tourmente, Quebec, about 60 km east of Quebec City, from about April 25 to May 20.

In the fall, the birds leave the Arctic breeding grounds in early September, when the soil and freshwater ponds



begin to freeze, journeying more than 1 000 km during the first segment of their odyssey. This takes them rapidly southward across Baffin Island to the central portion of the Ungava Peninsula in northern Quebec. There, they stage for several days, moving between many sites.

The second major part of the migration occurs when the birds are close to the tree line. Once again, they fly more than 1 000 km, following the boreal forest to the St. Lawrence River, where they arrive during the first half of October. About 80 percent of the geese stay there an average of 19 days—with the greatest concentrations from October 5 to 20—to replenish the energy reserves they need to continue their migration in early November to their wintering grounds in the United States. The geese that do not stop here fly directly to the United States Atlantic coast.

Since the 1970s, an important change has occurred in the way the Greater Snow Geese use the St. Lawrence staging area. The geese used to stage almost exclusively in the bulrush marshes near Quebec City before heading north in the spring, and flying non-stop to their wintering grounds in the fall. Now, in the spring, they gather at the Lac Saint-Pierre and other sites, moving west to east along the St. Lawrence River, before they head north. In the fall, the birds disperse from the Quebec City area in late October and move a short distance southwest towards Lac Saint-Pierre or northern Lake Champlain, where they feed in corn fields and where some remain well into November and December. Wildlife biologists have also noticed greater use of the more northerly Lac-Saint-Jean area in Quebec since 1995.

Feeding

The Greater Snow Goose is herbivorous, eating only plants. At the breeding grounds, it feeds on the roots and leaves of a large variety of grasses, sedges, and other plants 24 hours a day in the Arctic's round-the-clock summer daylight. Near the St. Lawrence River, it feeds primarily on the rhizomes, or roots, of bulrushes. Its strong, sharp bill is effective for digging the roots from thick mud. The snow goose also forages, or searches for food, in farm fields, where it feeds on waste oats and corn or grazes on grass, weeds, and clover. On the wintering grounds, it feeds on the roots of cord grass and other aquatic vegetation, but the goose is also found on farmland feeding on corn, soya, or winter wheat. Often, the Greater Snow Goose will forage in large flocks of 1 000 or more.

Breeding

The Greater Snow Goose breeds farther north than most other North American geese in small, loosely associated colonies.

Like most geese, Greater Snow Geese do not start breeding before they are two years old, and some even delay their first breeding attempt until they are four years old. They mate for life, taking another mate only if their partner dies. The geese arrive at their breeding grounds in early June, having paired elsewhere. Approximately 10 days after arriving, they build their nests on dry hummocks within wetlands and on hillsides and the protected slopes of ravines. The female selects the nest site, and only she builds it, although the male remains in the vicinity. The nest is usually concealed in a shallow depression in the ground and constructed of bits of dry vegetation that the female finds in the immediate area of the nest. She may lay her first egg within an hour of selecting the site, and as she lays more eggs, she may add nesting material, including a lining of down from her breast and belly.

The female has one brood, or set of young, in a year. She lays one egg every 36 hours, and usually lays a clutch of 4 or 5 eggs. She begins incubating, or warming, the eggs when the second-last or last egg is laid, and during the

following 24 days of incubation, the male stands guard, seldom straying more than 50 m from the nest. The female leaves her nest to feed several times a day, usually for about 15 minutes at a time. Unless she is frightened away, she always covers her eggs with down from the nest before she leaves it. This serves both to camouflage the eggs from predators and to keep the eggs warm until she returns.

Hatching takes place in early to mid-July. When the goslings leave their nest approximately 24 hours after the last egg has hatched, they can walk, swim, dive, and feed. They weigh about 100 g at birth and grow rapidly. Six weeks later they begin to fly. By then they weigh about 2 kg and have lost their yellowish natal down and acquired their grey and white juvenile plumage. They are ready for the southward migration by the first week of September. Both parents care for their young for an extended period, often for one year or more.

There are always nonbreeding birds in the flock. Birds that normally breed can skip breeding in a given year if they cannot accumulate sufficient fat and protein reserves or if climatic conditions are not favourable. In particular, a heavy spring snow cover on the breeding grounds can limit access to feeding and nesting sites, therefore forcing some geese to forgo breeding. The nonbreeders lose their flight feathers in July and are unable to fly for about three weeks while the new feathers are growing. Breeding birds begin their moult later and regain flight capacity at the same time as their young start flying, in mid-August.

Conservation

The Greater Snow Goose lives quite a long time. By banding and tracking birds, biologists have determined that while the average lifespan is six years, many Greater Snow Geese live longer than 16 years.

Greater Snow Geese have a number of natural predators: arctic foxes, arctic wolves, gulls, jaegers (birds that resemble gulls), Gyrfalcons, and ravens prey on the geese or eggs. Every three or four years, when lemming numbers crash, predators that rely almost exclusively on lemmings for food turn to goose eggs to supplement their diet. For

protection, snow geese will readily nest near Snowy Owls' nests. The owls' intolerance of foxes and jaegers on their territory is beneficial to the geese, and owls seldom attack goslings. During moulting, birds usually remain close to ponds and lakes, which provide easy escape from hungry foxes. Because few people visit the nesting grounds, humans do not pose a serious threat to the Greater Snow Goose in the Arctic.

A hundred years ago, the world population of Greater Snow Geese was estimated at approximately 3 000. By 1998, there were more than 800 000 Greater Snow Geese. Most likely, three factors are mainly responsible for this dramatic increase: a change in feeding habits, the establishment of sanctuaries, and restrictions on hunting of the Greater Snow Goose.

Before the mid-1970s, the Greater Snow Goose relied mainly on marshland vegetation for nourishment. Since then, changes in agricultural practices have led the bird to forage extensively in farm fields. In particular, the recent development of large-scale farming operations devoted to one crop, such as corn or cereals, have produced an unlimited supplement to the snow goose's traditional diet and led to improved survival of the geese during winter and during migratory stopovers.

The establishment of sanctuaries, where hunting is prohibited, as well as the protection of critical habitats in both Canada and the United States, have also contributed to the population increase. In Canada, the most important sanctuary for Greater Snow Geese is located on the St. Lawrence River at Cap Tourmente, Quebec, where the geese have traditionally stopped during their spring and fall migrations. In 1969, the Canadian Wildlife Service purchased a large tract of land at Cap Tourmente, making it a National Wildlife Area (NWA). In 1981, the Cap Tourmente NWA was declared North America's first Ramsar site, a site recognized as a wetland of international importance. Each October, visitors can view up to 100 000 Greater Snow Geese feeding along the 10 km of muddy shoreline at Cap Tourmente, and they can learn about the Greater Snow Goose and its habitat at a wildlife interpretation centre on the site. Large congregations

of Greater Snow Geese can also be seen at Montmagny, where a significant snow goose festival is held in October each year.

Bylot Island, which lies off the northeast coast of Baffin Island, and where the most important Greater Snow Goose breeding colony in the world is found, became a federal Migratory Bird Sanctuary in 1965. Bylot Island and adjacent areas on Baffin Island are also part of Sirmilik National Park, which was established in 1999.

Such measures as the 1916 signing, by Canada and the United States, of the Migratory Birds Convention, which banned commercial hunting, and tight restrictions on recreational hunting appear to have eventually led to a sharp population increase between 1968 and 1973. When the recreational hunt reopened in the United States in 1975, the population remained stable until 1983, an exceptionally good breeding year which launched a more recent population increase.

With Greater Snow Goose numbers rising as a result of these developments, wildlife biologists now consider North America's snow goose populations to be overabundant. During the 1980s and 1990s, a subsistence hunt by the Inuit of the eastern Arctic and a fall recreational hunt in southern Canada and the eastern United States was permitted. Since 1999, a special spring conservation harvest has been permitted in Canada to reduce the harmful effects of these large popula-

tions on the Arctic habitats where the geese breed. The population increase has stopped and there are signs of a recent decrease—there are now about 700 000 Greater Snow Geese.

The Greater Snow Goose has been intensively studied since 1955 by researchers from the Canadian Wildlife Service, the Quebec Wildlife Service, Université Laval, Université du Québec à Montréal, and Université du Québec à Trois-Rivières. This collaboration between various research and conservation partners has allowed us to acquire a comprehensive knowledge of the Greater Snow Goose's ecology during breeding, wintering, and fall and spring staging. This in turn allows sound conservation and management of the species.

Resources

Online resources

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lavoieverte.qc.ec.gc.ca/faune/faune/html/nwa_ct.html

Ducks Unlimited: www.ducks.ca

U.S. Fish and Wildlife Service:
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Catalogue number CW69-4/37-2003E
ISBN 0-662-34283-6
Text: J.D. Heyland
Revision: A. Reed, 1993; E.T. Reed, 2003
Editing: M. Kavanagh, 2005
Photo: E.T. Reed (CWS)



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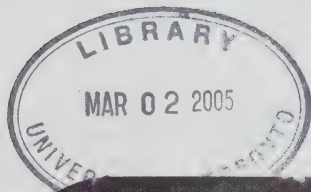
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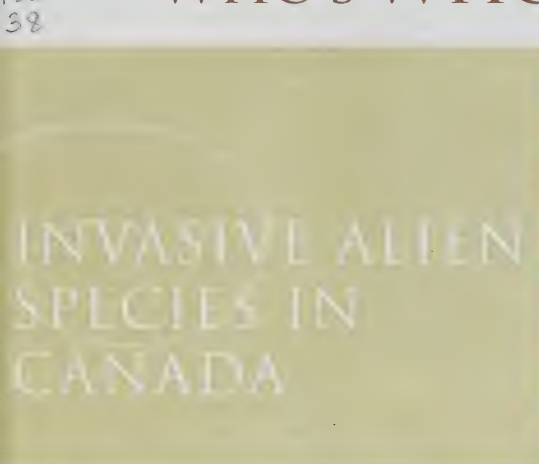


Canada

Également disponible en français sous le titre *La Grande Oie des neiges*



HINTERLAND WHO'S WHO



INVASIVE ALIEN SPECIES IN CANADA
A REPORT FOR THE GOVERNMENT OF CANADA
BY THE CANADIAN COAST GUARD
AND THE CANADIAN MARITIME SECURITY
AGENCY

Sometimes the conditions are right for alien species to become *invasive*—they move into new habitats and take over, their populations sometimes expanding beyond control. The harm they cause to the environment, the economy, or human health can be costly and sometimes irreversible.

What are invasive alien species?

Canada is being invaded by aliens, but not by the type you see in science fiction movies. These organisms are found nearly everywhere in Canada. They can belong to any of the categories of organisms in the world, including plants, mammals, birds, reptiles, amphibians, invertebrates, and micro-organisms. They include species native to one part of Canada that move to another region of the country, as well as those that come from outside the country. These aliens are any species that has spread beyond its natural range into new locations as a result of human activity.

You are already well acquainted with some alien, or non-native, species. For example, lawns and gardens are made up mostly of alien species, including Kentucky bluegrass, periwinkle, lily of the valley, and even the unwanted dandelion. The

domestic cat is thought to have originated in Africa. And the pigeon and the European Starling, birds commonly seen in Canadian cities, both came from Europe. Even many of the foods you eat originated in other countries. Potatoes came originally from the South American Andes, corn from Mexico, and wheat from Africa and the Middle East.

There are also many examples of species from one part of Canada that have taken up residence in another. The familiar moose, for example, is native to most parts of the country, but is an introduced species on the island of Newfoundland, as are the red squirrel and the snowshoe hare. The bullfrog is native to some provinces, but is an alien species in British Columbia. And the House Finch, which originated in several western provinces, is now found in a number of provinces in the east.

Many of Canada's alien species are beneficial, but a great number are not.

Where do they come from and how do they get here?

Alien species come into Canada by any means of transport that moves them farther than they could move on their own. Sometimes they are brought in on purpose, but often they arrive unintentionally.

Seafaring European explorers and settlers were the first to introduce new species to Canada. They brought cattle, goats, and other domestic animals, along with familiar crops like wheat, when they came by ship to explore and settle the New World. Without meaning to, they also introduced unwanted organisms—pests, like the Norway rat, and viruses, like deadly influenza and smallpox.

Today, alien species are still being imported intentionally into Canada from

around the world for use in many areas, from agriculture and horticulture to the pet trade to medical and scientific research. A variety of legislation regulates the importation of alien species into Canada and their movement once they are in the country. Unfortunately, even when programs are in place to monitor and contain imported species, the effects the species can have on the environment if they accidentally escape from their intended habitat is not always considered.

It is more difficult to trace the pathways of species that have been introduced accidentally than it is those introduced intentionally. Accidental arrivals are rarely discovered until they have become invasive and spread some distance from their point of entry. For example, many unwanted aliens arrive in ballast water, the seawater or freshwater used to stabilize large ships during travel; aquatic species are taken up along with ballast water at one port and released at the destination port. About half of the alien shellfish species in Canada, including the highly

invasive zebra mussel, probably arrived in North America in this way. Shipping-crate wood and packing materials may also contain unwanted species, such as insects. As well, unwanted aliens may travel with intentionally imported ones. For example, plants, seeds, and bulbs that are imported for use in landscaping may harbour foreign insects and fungi or may be contaminated with the seeds of other plants. Domestic animals and aquaculture species may carry foreign diseases or parasites.

Alien introductions into Canada are becoming more frequent and difficult to track as global trade and travel expand. Europe used to be the main area of origin of alien species. In recent years, more species have been arriving from Asia, some with telltale names like the Asian long-horned beetle, Japanese bamboo, and Eurasian water milfoil. More frequent travel between regions within Canada is also speeding up the spread of alien species to remote areas, isolated water bodies, and islands.

Why are we concerned?

When an alien species enters an ecosystem, it can have an impact on the species that are present, on important habitats, or even on the ecosystem itself. Concern arises when an alien species changes the system for the worse, either by reducing or eliminating populations of native species, or by otherwise changing the way the ecosystem works.

These changes have made the invasion of alien species a major global problem. If organisms were not able to move beyond their normal ranges, each part of the world would have a unique array of plants, animals, and micro-organisms. But as species move from one area of the world to another, sometimes squeezing out the competition, different places in the world become more alike in their biology—a process called *biological homogenization*.

This process is undesirable because as it takes place, ecosystems often become less stable, and valuable biodiversity, or variety of life, is lost. This variety is essential to the health of our planet; each species performs a function that contributes to global well-being. The spread of invasive alien species, like habitat loss, is considered one of the major threats to biological diversity. Invasive alien species have obliterated about 110 vertebrate species around the world and have affected nearly every type of ecosystem. For example, in New Zealand, predatory European mammals such as rats, cats, and stoats have caused the extinction of nine native bird species, and they threaten many more. In Guam, the brown tree snake, an import that arrived hidden in ship cargo from New Guinea, has wiped out virtually all the island's native forest birds.

In Canada, about 5 percent of mammal species and 27 percent of vascular plant species are aliens. The number of many other alien species is not yet known.

Invasive aliens pose a problem mainly in places with a warmer climate and a disturbed landscape. In Canada, these two factors come together in the south, where most of the human population lives. Urban and industrial development and activities



Photo: Cory Lindgren

Purple loosestrife, introduced from Europe in the early 1800s as a garden ornamental plant, has invaded wetlands throughout eastern North America, edging out many native species. Wetlands are the most biologically diverse part of our ecosystem. When the purple flower chokes out habitat, it affects hundreds of species of plants, birds, mammals, reptiles, insects, fish, and amphibians that rely on wetlands to survive. Only three provinces prohibit the sale of purple loosestrife; it can still be purchased in garden centres everywhere else in Canada.

such as forestry and agriculture disturb the landscape in ways that make it more vulnerable to alien invasions and endangerment of native species. In particular, southern British Columbia, Ontario, and Quebec are home to a large number of both invasive aliens and species at risk. Natural communities on islands are also particularly vulnerable to invaders. Their plants and animals have evolved in isolation from the mainland, and they do not have the adaptations needed to escape from or compete with outsiders. Almost half the mammal species found on the island of Newfoundland and on the Queen Charlotte Islands are invasive aliens.

The cost of the damage caused by invasive alien species in Canada and the cost of controlling these species is not precisely known. But these costs are considerable and will continue to grow. Forestry companies and farmers lose millions of dollars in products each year because of alien pests and disease, and they spend millions more on pesticides, fungicides, and herbicides to control the invaders. Another example involves an aquatic invader. Tens of millions of dollars have already been spent repairing the damage caused by the zebra mussel to industrial intake and output pipes and to locks and other waterway structures in the Great Lakes system. Unless checked, further damage by this invasive mollusc over the next 10 years is expected to cost Canada and the United States another \$5 billion. Invasive aliens also take a toll on health. The West Nile virus, for example, a disease transmitted by infected mosquitoes, has caused numerous deaths in humans and wildlife in Canada and the United States since it was first detected in North America in 1999.

What can be done?

The problem of invasive alien species is so large that it cannot be properly dealt with unless groups and countries work together to monitor the progress of invasive aliens and come up with solutions. Experts from many countries are now cooperating on programs like the Global Invasive Species Program to help develop a worldwide plan to deal with this problem.

How invasives thrive

Aliens that are successful invaders are species that have some advantage over native species. These advantages are often enhanced when aliens move into ecological niches and thrive because, outside their natural environments, they are not held back by natural predators, parasites, disease, or competition in the way that native species are. Here are some Canadian examples of how alien species affect the species around them:

Competition: In many cases, invasive aliens out-compete native species for space, water, food, and other essential resources. For example, non-native starlings eliminate native Canadian birds like bluebirds, Red-headed Woodpeckers, and Tree Swallows by taking over their nesting sites. In addition, often aliens reproduce more successfully than indigenous species, quickly outnumbering the natives.

Many threatened and endangered species are placed at grave risk by invasive aliens. An estimated 16 percent of endangered plants in Canada are negatively affected by competition with invasive alien plant species. For example, endangered native white wood aster, ginseng, and wood poppy are all threatened by the invasion of non-native garlic mustard.

Predation: Some invasive aliens cause native populations to decline by being aggressive herbivores or predators – defoliating or overgrazing native plants or preying on native animals. Introduced rats and raccoons eat the eggs and nestlings of Ancient Murrelets and other seabirds living on the coast of the Queen Charlotte Islands. By depleting this population, the aliens may also be affecting the vulnerable Peale's Peregrine Falcon, for which Ancient Murrelets are a food source. Another invasive, the gypsy moth, defoliates, or eats the leaves of, many tree species. This causes widespread damage to Canadian forests and huge losses to the forest industry.

Disease: Sometimes, invasive alien species are diseases. Chestnut blight, a fungal disease that came to North America on nursery stock from Asia

around 1900, has devastated the population of American chestnut trees in eastern Canada and the United States.

Parasitism: At times, invasive alien species feed on, or parasitize, native species, severely weakening them but not necessarily killing them. The sea lamprey, which parasitizes other fish, was introduced into the upper Great Lakes in the 1800s and early 1900s. With other factors, it was responsible for severely reducing the native population of lake trout, the system's top natural predator.

Hybridization: Sometimes invasive aliens weaken the gene pool of native species by interbreeding with them, a process called *hybridization*. In southwestern Ontario, native red mulberry is imperilled by hybridization with the alien white mulberry, brought to Canada from China in an attempt to start a silk industry here. With continued hybridization, the gene stock of the red mulberry is becoming diluted. There are now as many stands of hybrid mulberry as red mulberry.

Habitat alteration: When they change the structure or composition of a habitat, invasive alien species make it unsuitable for other species. This process is called *habitat alteration*. Careful management of the introduced moose is required to prevent overgrazing of forests and wetlands on the island of Newfoundland. Foresters in areas that are overpopulated by moose find that the animals' grazing harms the regrowth of forest trees. This may seriously reduce future timber crops as well as the breeding habitat of songbirds that nest in deciduous shrubs. Overgrazing can also expose low-nesting birds and leave them vulnerable to predation.

Alien species can also seriously affect the environmental processes that all species, including humans, depend on. For example, the alien aquatic plant Eurasian water milfoil forms dense mats along shorelines and in slow-moving rivers. These mats sometimes interfere with the local nutrient cycle. When they die and decay, large amounts of phosphorus are added to the water, making it too rich in nutrients.

An increasing number of countries around the world are also creating individual strategies and action plans on invasive alien species. In Canada, a comprehensive national plan to address the threat of invasive alien species, including invasive aquatic and terrestrial animal and plant species, is now being developed through the collaboration of federal, provincial, and territorial governments. In addition, many government and nongovernment groups run projects to monitor and control invasive alien species. For example, Environment Canada's EcoAction program supports community projects across the country to monitor and eradicate purple loosestrife and other invasive aliens.

By the time invasive aliens are detected, their populations have grown significantly, and they have usually spread far from their point of introduction. Controlling them at this stage is very difficult, sometimes impossible; it is better to prevent them from coming into the country. Over the years, Canada has instituted many laws, regulations, and policies aimed at achieving that goal.

In 1992 Canada joined the United Nations Convention on Biological Diversity. This international agreement aims, among other things, to prevent the introduction of alien species that threaten ecosystems and to control or get rid of alien species that are already established. Under this agreement, Canada developed the Canadian Biodiversity Strategy in 1995. This strategy supports monitoring and controlling the importation of alien species.

Keeping Canada's ecosystems healthy and undisturbed is another way to help slow the advance of invasive aliens or prevent them from becoming a nuisance.

Keeping all alien species out of Canada is not practical, even though it would help us conserve our natural ecosystems. For one thing, enforcing Canada's laws and guidelines about alien species is very difficult. For example, only about 1 to 2 percent of shipments arriving at Canada's borders are inspected for alien species, so there is a great chance that accidental introductions will happen. Another consideration is Canadians' desire to have a variety of foods, up-to-date



Photo: Yves de Lafontaine

Zebra mussels attached to a native freshwater mussel

medicines, non-native pets, and strong scientific research programs, so that some importation of alien species must be allowed.

Canada's laws prohibit some species from entering the country. Others are allowed in after they have been assessed, reducing the risk that alien species will become invasive and cause environmental and economic losses. However, it is not easy to predict how invasive and damaging a species will be before actually observing it "in action." Once an alien species is established, some type of control may be necessary to reduce the harm it can do. Because resources are limited, decisions must be made about which invasive aliens cause the most harm and need the most control. Here are the four main methods used to control alien populations, along with some examples of how they are used in Canada:

Physical control: Physically removing the species from its environment includes pulling out unwanted plants by hand or machine; tilling soil; burning an area; and snaring, trapping, and shooting unwanted animals. An example of this is burning off invasive plants to restore a natural prairie grassland.

Chemical control: Pesticides, herbicides, fungicides, and other chemicals are used

to kill target alien species on contact or to indirectly kill them or their offspring by damaging their essential life processes or ability to reproduce. An example is the use of poison to eradicate rats from Langara Island, one of the Queen Charlotte Islands. Chemical control was widely used in the past but is now used less because of possible harmful effects on non-target species, both wildlife and human.

Biological control: Living organisms, particularly predators, parasites, and disease, are used to control the growth of alien populations. Many organisms used to control alien species in Canada are aliens themselves—prey-specific predators brought in from the natural range of the species being controlled. An example is the introduction of host-specific plant-eating insects or parasites to control leafy spurge, purple loosestrife, and gypsy moth.

Integrated control: This involves a combination of control methods, changes in land use practices, and preventative methods like habitat rehabilitation that are used to control alien species and to prevent their recolonization. An example is the use, by Parks Canada, of a variety of control methods to carry out the agency's job of protecting the ecological health of Canada's national parks system.

Monitoring, research, and education

People in Canada have only recently begun to keep track of alien species and invasives. Continued work is needed to monitor the arrival and progress of alien species in Canada. Researchers must also learn more about what allows a species to become invasive and which controls are the most effective. To fill these and other gaps in our knowledge and to produce materials on invasive alien species that are useful for scientists and ordinary citizens, much work will be required.

As people become more aware of the problem of invasive aliens, they will be more likely to make good decisions to help prevent and deal with this problem. Publications like this one inform teachers, students, and other interested Canadians about the problem. Conservation groups can help get the message out to their members. Industry groups, like nurseries and pet stores, can become more aware of the role they play in introducing alien species to Canada.



How can you help?

Individuals are responsible for the introduction of many alien species to Canada. You can do your part to help prevent further invasions by following these principles:

- Do not release alien plants or animals (including pets and live bait) into the wild.
- Do not bring fruit, vegetables, plants, or animals with you across international

borders. Be cautious about what you carry across interprovincial borders.

- Before taking a recreational trip, inspect and clean fishing equipment, boats, trailers, recreational vehicles, and other items that may harbour hitch-hiking invaders.
- Do not transport over long distances firewood or other wood with bark attached.
- Learn which plant species are invasive, and remove them from your garden. See the resources list at the end of this fact sheet for information on some invasive alien plant species. Take special care with water garden plants, as many are invasive. Be aware that native grass or wildflower seeds sold through seed catalogues sometimes include seeds from alien species. If you are unsure about a new species, plant it where you can easily control its spread, and remove it if necessary. Avoid planting alien species next to, or within, natural areas, roadsides, or forested fence rows.
- Keep natural habitats on your property healthy.
- Volunteer with local environmental organizations that work to maintain healthy ecosystems or restore degraded ecosystems.
- Know where consumer products come from (especially food, pets, and biological pest-control products). Buy from local sources where possible, and be particularly cautious about purchasing from Internet-based companies.

Resources

Online resource

Canadian Endangered Species Conservation Council—*Wild Species 2000: The general status of species in Canada*: www.wildspecies.ca

Environment Canada—EcoAction: www.ec.gc.ca/ecoaction

Federation of Ontario Naturalists—Natural Invaders: www.ontarionature.org/enviroandcons/naturalinvaders/invasive.html

Global Invasive Species Programme: www.gisp.org

Great Lakes Information Network—Invasive Species in the Great Lakes: www.great-lakes.net/envt/flora-fauna/invasive/invasive.html

Invasive Plants of Canada Project: www.plantsincanada.com

Invasive Plants of Natural Habitats in Canada: www.cws-scf.ec.gc.ca/publications/inv/index_e.cfm

IUCN (World Conservation Union) Invasive Species Specialist Group: www.issg.org; includes the booklet 100 of the World's Worst Invasive Alien Species: www.issg.org/booklet.pdf

The Nature Conservancy (United States)—Invasive Species Initiative: nature.org/initiatives/invasivespecies/

Ontario Federation of Anglers and Hunters—Invading Species: www.invadingspecies.com

United States National Invasive Species Council: www.invasivespecies.gov

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Catalogue number CW69-4/102-2004E

ISBN 0-662-34262-3

Text: Michelle Lee and Mark Hovorka

Editing: Joan Gregorich and Maureen Kavanagh

Photos: Cory Lindgren (purple loosestrife); Yves
de Lafontaine (zebra mussels); Kenneth R. Law,
USDA, APHIS, Plant Protection and Quarantine,
Newburgh, New York (Asian long-horned
beetle)

The Canadian Wildlife Service

The Canadian Wildlife Service of Environment Canada handles wildlife matters that are the responsibility of the Canadian government. These include protection and management of migratory birds as well as nationally significant wildlife habitat. Other responsibilities

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are species at risk, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

Visit *Hinterland Who's Who* on the Web at www.hww.ca.

Hinterland Who's Who is a collaboration between the Canadian Wildlife Service and the Canadian Wildlife Federation.



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Également disponible en français sous le titre *Les espèces exotiques envahissantes au Canada*

HINTERLAND WHO'S WHO

LEAD POISONING OF WATER BIRDS



Photo: Jack Daulton

- For every bird that a hunter hits, about 1 000 lead pellets from shotgun shells fall to the ground.
- Many birds can get lead poisoning because of the food they eat or the way they find their food.
- If a bird swallows more than six lead pellets, it will probably die within a few days.
- Shotgun pellets do not have to be made of lead.

Lead shot, sinkers, and jigs

Every year in Canada many ducks and other birds die from lead poisoning. They get lead poisoning mainly by eating lead shotgun pellets and lead fishing sinkers and jigs that have fallen into their feeding grounds.

People use shotguns for hunting and for skeet or trap shooting (shooting clay targets that are thrown into the air to simulate the flight of a bird). Lead shotgun shells used for most game bird hunting contain about 280 lead pellets, weighing about 35 grams in all. A hunter usually fires several shells for every bird that is hit. Only a few of the pellets actually hit the bird. The rest—more than 1 000 pellets—fall to the ground or into the water.

Before 1996, Canadian hunters and target shooters shot into the environment about 2 100 tonnes of lead shot (one tonne equals 1 000 kilograms) annually. Since the ban on the use of lead shot in National Wildlife Areas in 1996 and the national ban on its use for waterfowl hunting in wetlands in 1997 and for hunting most migratory game birds in 1999, this amount has dropped to about 1 600 tonnes per year. Lead shot builds up in the bottom sediments and surface soils of popular hunting sites. Fields where hunting takes place, or the bottoms of lakes and marshes where people hunt, may contain 40 000 to 180 000 lead shot pellets for every hectare (one hectare equals 10 000 square metres). That's like finding 20 to 80 pellets in an area the size of a 2-metre x 2-metre sandbox. One heavily hunted lake in Manitoba has as many as two million pellets in every hectare of its

bottom, the same as 800 pellets in a sandbox.

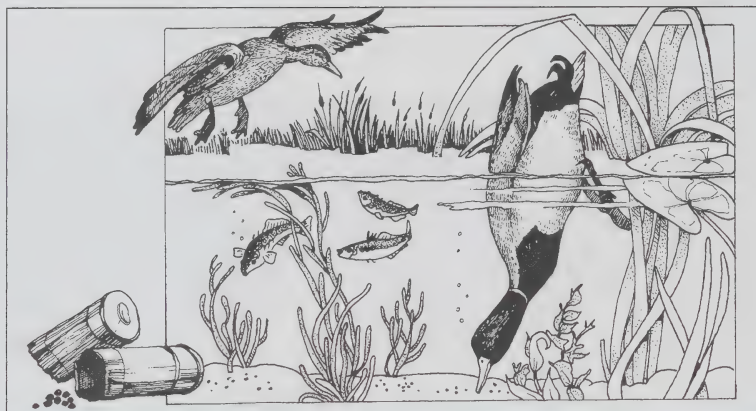
About 260 tonnes of lead shot falls to the ground each year around clay-target shooting ranges in Canada. Depending on where the ranges are located, some of this shot falls into wetland areas, where it can be swallowed by water birds.

Recreational anglers (people who fish using a hook and line) often attach lead weights to their fishing line to sink the hook and bait or lure in the water. They may also use lead jigs, which are weighted fish hooks. Fishing sinkers come in all shapes and sizes.

Sometimes people accidentally drop loose fishing sinkers or jigs into the water. Sinkers and jigs may also be lost in the water if the hook or line gets tangled and the line breaks or is cut. Scientists estimate that about 530 tonnes of lead sinkers and jigs are lost in Canadian waters every year.

Birds at risk

Many species of birds can get lead poisoning because of the food they eat or the way they find their food. In Canada, these birds include surface-feeding ducks (also called dabbling



When feeding, waterfowl may mistake lead shot for food or grit.

ducks), loons and grebes, sea ducks, cranes, herons, geese, swans, birds of prey, and scavengers. Other species are also victims of lead poisoning. For example, game birds and small mammals (like rabbits) that have been wounded by hunters or weakened by lead poisoning are easily captured by birds of prey.

Waterfowl and other water birds that dig for their food in the bottom of lakes and ponds, or in the soil in hunted fields, are at the greatest risk. For example, you often see dabbling ducks such as Mallards tipped down in the water with their tails poking up while they are feeding. They may swallow lead shot pellets when they probe the bottom for food, mistaking them for food items like seeds, molluscs (small snails or clams), and insects. They may also mistake them for grit, which is small stones that they eat to help them grind up food in their gizzards, a muscular part of the stomach that grinds food. The species that are most commonly documented to be poisoned by lead shot are Mallards, Black Ducks, Northern Pintails, Canada Geese, Snow Geese, and Tundra Swans.

In Canada, the bird that is most reported as poisoned by eating lead sinkers is the Common Loon. Ducks, geese, swans, herons, Bald Eagles, and snapping turtles are also known to swallow fishing sinkers. Sinkers weighing less than about 50 grams are the ones usually swallowed by water birds.

Lead poisoning

Because lead is poisonous, Canada controls how much of this metal is allowed in water, air, soil, food, and manufactured products like gasoline and paint.

Lead shot or sinkers that a bird ingests are usually trapped in the gizzard. As this muscular part of the stomach grinds the food, it also grinds the lead pellets or sinkers, breaking them down into small pieces. The acid in the gizzard dissolves these pieces, and the lead moves into the bird's bloodstream.

The blood carries the lead around the body, and it accumulates in the bones and the vital organs, like the kidneys, brain, and liver. If enough lead builds up, these organs can be damaged. If a bird swallows more than about six lead pellets, it will probably die very quickly—in a few days. This is called *acute lead poisoning*.

If the bird swallows a smaller number of pellets, it may gradually become very weak and die of starvation. This happens because the digestive system becomes paralyzed, and food cannot move through the system and be digested. This is called *chronic lead poisoning*.

Water birds can be poisoned long after the shot or sinkers first fall to the ground or into the water. This is because lead

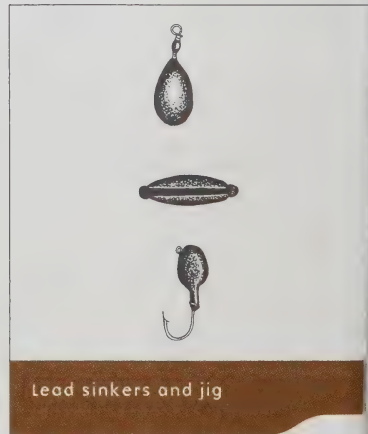
shot and sinkers generally take decades to break down in the environment.

Lead poisoning of wildlife can happen at any time of the year, but is usually greatest during and after the fall hunting season. Waterfowl hunters often hunt along migratory paths, where large flocks of ducks and geese gather in the fall. As a result, lead shot often builds up in the very areas that water birds use as resting and feeding stations during migration.

Lead sinkers are found in areas that are fished, like along the shorelines, rocky places, and piers of lakes, ponds, and streams. These areas often overlap with the breeding and feeding grounds of water birds. Water birds can swallow lead sinkers or jigs any time the water is open (not frozen).

A bird that has lead poisoning acts very strangely. It may fly poorly and have crash-landings, or it may stagger around the ground. As the poisoning gets worse, the bird may not be able to fly or walk at all. It eats very little and hides away by itself, staying behind when other birds have migrated. Because of its weakness, it may have trouble fighting off other diseases and escaping from predators. A lead-poisoned bird may lose a lot of weight, get droopy wings, and have green diarrhea.

Even when there are no clear signs of lead poisoning, a bird may still be in trouble. It may not be able to find food, mate, build a nest, lay eggs, or care for its young properly.



Lead sinkers and jig

Seriousness of the problem

Lead shot and sinkers can break down in the environment, transferring lead to the soil and water. The soil at some clay-target shooting ranges contains enough lead to be classed as *hazardous waste* under Canadian guidelines.

Lead breaks down most quickly where the soil and water are acidic and full of oxygen. When it is attached to soil particles, lead can be moved to new places by erosion. Lead that is dissolved in water can run off into nearby water or move down through the soil into the groundwater. It can also be taken up from the water or soil by plants.

Although many thousands of birds probably die each year from lead poisoning, the actual number of birds poisoned by lead is not known. Poisoned birds often hide themselves and die in out-of-the-way places where they are never found. They are also eaten by predators, like Bald Eagles, and scavengers, like vultures and foxes, which usually leave little trace of their prey.

Depending on the location, poisoning from swallowed lead sinkers or jigs accounts for up to half of all Common

Loons found dead in eastern Canada and the United States.

No one knows for sure how many animals die of *secondary poisoning* (getting lead poisoning by eating an animal with lead shot in its body), but the numbers can be high for some species. For example, in recent years about 15 percent of Bald Eagles and 13 percent of Golden Eagles found dead in British Columbia and the Prairies died of lead poisoning.

Many bird populations are shrinking because their habitats are being destroyed. Lead poisoning is one more problem that confronts these birds. Some species at risk, like the Whooping Crane, may swallow lead shot or sinkers. Others, like the Peregrine Falcon, may eat birds that carry lead shot embedded in their flesh. The death of even a few individuals may affect the survival of a species at risk.

Dealing with the problem

Shotgun pellets do not have to be made out of lead. Shot made from steel or bismuth is not poisonous if swallowed by birds. Hunters may be reluctant to switch to steel shot at first, because it may cost a little more and they are concerned that it might cripple more birds than lead shot.

But, although there are differences between lead shot and steel shot, hunters who practise proper shooting techniques can reduce crippling of game birds and small mammals no matter which type of shot they use. Researchers believe that more birds die from lead poisoning and crippling when hunters use lead shot than from crippling when hunters use steel shot. Several countries, including the United States, the United Kingdom, Sweden, Norway, Finland, Denmark, the Netherlands, and Australia have established regulations requiring the use of non-toxic shot for certain types of hunting and target shooting.

Fishing weights and jigs can also be made from non-toxic metals such as bismuth, tin, tungsten, stainless steel, and special putty.

In 1991, Canada banned the use of lead shot in some "hot spots" across the country (places where lead-shot poisoning of waterfowl was known to be a problem). But this restriction was hard for wildlife conservation officers to enforce, because lead shot could still be used in all other hunting areas. Also, researchers found that elevated lead exposure in waterfowl in Canada was more wide-spread than they first thought.

So Canada began to expand the requirements to use non-toxic shot for the protection of waterfowl and their predators. Non-toxic shot was required in National Wildlife Areas in 1996, in wetland areas in 1997, and for hunting most migratory game birds in 1999. This ban on lead shot has been carried out under federal laws called the *Migratory Birds Convention Act* and the *Canada Wildlife Act*. These laws were designed to help control the problem of lead poisoning of waterfowl and have reduced the amount of lead shot entering the environment by about 40 percent. Also, recent surveys have shown that lead exposure of ducks in Canada has dropped by at least 50 percent since nontoxic shot regulations were put in place. Federal regulations do not deal with target shooting or hunting of most upland game birds and mammals, which are covered by provincial laws.

In 1997, Canada also banned the use of lead fishing sinkers and jigs weighing less




Photo: Pierre-Yves Daoust

X-ray showing lead sinkers swallowed by a Common Loon

than 50 grams in its National Wildlife Areas and national parks. This ban was carried out under the *Canada Wildlife Act* and the *National Parks Act*. About 560 tonnes of lead is used in lead sinkers in Canada each year. Under the ban, only about five tonnes of lead a year, or less than 1 percent of the total amount used, has been removed from the environment. As researchers continue to study whether lead fishing sinkers and jigs cause a conservation problem in Canada as a whole, new rules may be made to control the use of this type of fishing tackle.

Resources

Online resources

Canadian Wildlife Services – Fish Lead
Free: www.cws-scf.ec.gc.ca/fishing

Michigan Department of Natural Resources – Lead poisoning in waterfowl: www.michigan.gov/dnr/0,1607,7-153-10370_12150_12220-26676--,00.html

United States Environmental Protection Agency – Lead Fishing Sinkers and Animals: www.epa.gov/owow/fish/animals.html

United States Geological Survey National Wildlife Health Center – Fact Sheet: Lead Poisoning in Migratory Birds:
www.nwhc.usgs.gov/whats_new/fact_sheet/fact_lead_poisoning.html

Washington Swan Working Group – Lead poisoning issues: www.swansociety.org/issues/lead/0102lead.html

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Catalogue number CW69-4/96-2003E
ISBN 0-662-34285-2
Text: J. Gregorich
Revision: Stacey Norris, 1997;
A.M. Scheuhammer, 2003
Editing: Maureen Kavanagh, 2005
Photos: Jack Hughes (Canada Goose);
Pierre-Yves Daoust, Atlantic Veterinary College (X-ray)
Illustrations: Judie Shore (waterfowl);
Michael Cooper (sinkers)



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are species at risk, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

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Également disponible en français sous le titre *L'Intoxication par le plomb des oiseaux aquatiques*



HINTERLAND WHO'S WHO

LEATHERBACK SEATURTLE



Photo: NSLTWG

- The leatherback sea turtle is the world's largest reptile and can grow to more than 2 m and weigh over 900 kg.
- has been recorded to dive depths of 1 270 metres
- faster than any other reptile, and a single turtle can travel almost 100 km in a day
- possesses a combination of adaptations that allow it to survive in water that is much colder than other reptiles in the
- is a challenge for scientists to study and has never been successfully raised in captivity or kept in a

Description

The leatherback sea turtle is the world's largest reptile. It is significantly larger than all other marine turtles. The leatherback's body is teardrop-shaped, tapering at the rear to a blunt point. The carapace, or upper shell, can grow to more than 2 m in length, and the turtle can weigh more than 900 kg. Like all sea turtles, the leatherback has both front and rear flippers, but it is the only sea turtle whose flippers have no claws. Its large front flippers are usually at least half as long as its carapace. The leatherback, like other sea turtles, cannot retract its head or flippers under its shell as tortoises and freshwater turtles can.

The leatherback is also the only sea turtle that does not have a hard shell or scales.

Instead, its carapace is covered with the leathery skin that gives the turtle its name. The skin covers a thick layer of oil-saturated fat and connective tissue and a matrix of small bony plates that fit together, almost like a jigsaw puzzle, to form the shell. Seven ridges run the length of the turtle's carapace, which is a dark bluish-black colour. Sometimes the turtle's carapace appears brown when it is seen in the water. The leatherback's carapace, neck, head, and front flippers are usually covered with white or bluish-white blotches. Its plastron, or bottom shell, is pinkish-white.

Leatherbacks have a pink patch on the top of the head. Each pink spot, like a human fingerprint, is unique. Scientists are not certain what function the pink spot has,

though some think it might help the turtle sense light or determine where it is located in the ocean.

Habitat and habits

Leatherbacks are powerful swimmers, covering enormous distances in relatively short periods. For example, a turtle that was found in the waters off Cape Breton Island, Nova Scotia, travelled as far south as Trinidad in four months. Using their front flippers in a motion that looks much like a bird flapping its wings, leatherbacks propel themselves through the water. Scientists have recorded speeds of up to 9.3 km per hour, but a likely average is closer to 2.5 km per hour.

Leatherbacks are one of the world's deepest-diving vertebrates. The maximum recorded dive depth for a leatherback is 1 270 m. Like all reptiles, the leatherback breathes air. Although it is able to stay under water for more than an hour, a leatherback usually does not spend much more than half an hour beneath the surface.

A combination of adaptations allows leatherbacks to survive in water that is much too cold for other marine turtles. These include the dark body colour, a

thick layer of fat, and a high volume-to-surface-area ratio. This means that the turtle has a significant body mass, or volume, and a relatively small surface area compared to the mass, allowing the turtle to retain body heat.

Leatherbacks also have “countercurrent” heat exchangers in their flippers. This means that the veins and arteries are closely bundled next to one another, so that the warmer blood carried away from the heart in the arteries helps to warm the cooler blood returning to the heart from the veins. All of these factors help the leatherback maintain a core body, or internal, temperature, which is as much as 18°C warmer than the surrounding water temperature. Some scientists even hypothesize that the leatherback might have some capacity to generate its own body heat, like a mammal, even though reptiles are ectotherms—or “cold-blooded”—which means that their body temperature depends upon the temperature of the surrounding environment.

The leatherback has never developed the ability to swim backwards. This poses some difficulty when an animal encounters fishing nets and lines in the ocean because it has no hope of backing out of them. It also poses a major difficulty to scientists attempting to raise leatherbacks in captivity. In fact, leatherbacks have never been successfully raised to maturity in captivity.

Leatherbacks kept in a tank continually propel themselves against the sides of the aquarium as they ceaselessly swim forward. They inevitably damage themselves in the process and develop lethal fungal infections as a result. Not being able to raise leatherbacks in captivity means that scientists cannot observe captive specimens to determine how quickly they grow or how long they live. It also means that a “head-start” program cannot supplement leatherback conservation efforts. A head-start program would keep hatchling leatherbacks in captivity until they grew to a size that makes them less vulnerable to predators.

Because male turtles never return to land after hatching, collecting information on males must take place at sea, a difficult prospect given the great distances the

turtles travel. The majority of leatherback scientists study individuals on the nesting beaches. As a result, the information available on leatherbacks is heavily biased toward female turtles.

Range

The leatherback sea turtle ranges further than any other reptile, with single turtles migrating across entire ocean basins. Leatherbacks can be found in the tropical, temperate, and boreal, or northernmost, waters of the Atlantic, Pacific, and Indian oceans. They are also found in the Mediterranean Sea. The northernmost recorded latitude of a leatherback is 71°N and the southernmost is approximately 27°S. In Canada, the leatherback sea turtle can be found off the coasts of British Columbia, Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island. There have also been records of turtles off Baffin Island and in the Gulf of St. Lawrence near the city of Québec.

Although scientists have a sense of where leatherbacks are found in the world, they are still in the early stages of understanding what migration routes leatherbacks take to get from the tropical waters near their nesting beaches to the temperate and boreal waters where they forage, or search for food, at other times of the year. This information is crucial to helping conserve the leatherback.

Feeding

The primary reason that leatherbacks migrate north is to feed on jellyfish, which are their principal prey. The turtles will also eat other soft-bodied creatures, such as salps. Salps are soft-bodied, gelatinous, free-swimming marine invertebrates with a transparent barrel-shaped body.

Like all turtles, leatherbacks do not have teeth. They do have two cusps, or pointed parts, one on the upper jaw and one on the lower jaw. These are not used to “chew” food, but to grab it. To aid in feeding, the leatherback’s entire esophageal tract, or gullet, is lined with sharp spines that point downward. Scientists suggest that these spines prevent jellyfish from escaping from the leatherback’s mouth, and they

help to shred the jellyfish to pieces as it travels down the esophagus to the turtle’s stomach.

Breeding

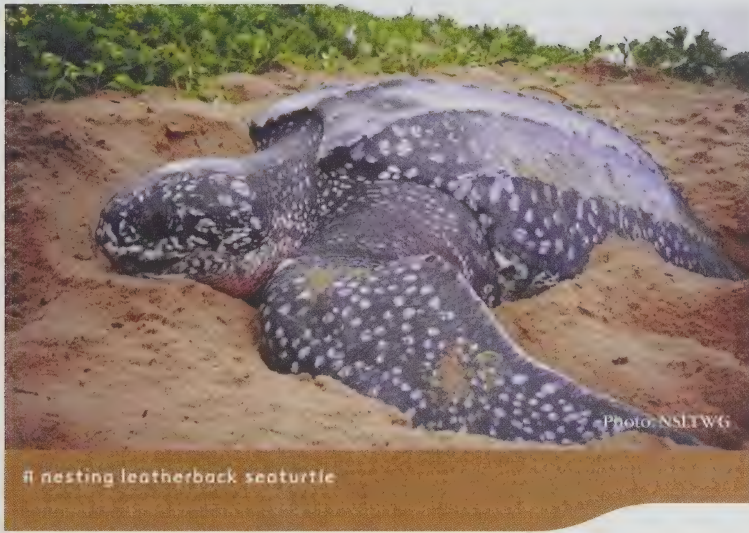
Like almost all reptiles, leatherback sea turtles hatch from eggs laid on land. The major leatherback nesting beaches are in Trinidad, French Guiana, Suriname, St. Croix and the United States Virgin Islands, Papua New Guinea, Mexico, Pacific Costa Rica, Irian Jaya, and Gabon. They do not nest in Canada. In the United States, the turtles nest in Florida and occasionally in Georgia.

Nesting is the only time a sea turtle will return to land, and only the females nest. Male turtles never return to land after hatching. Mating takes place at sea.

Leatherbacks nest every two to three years. Atlantic leatherbacks nest an average of six times from March to July, with approximately 10 days between the nesting episodes, while Pacific leatherbacks are thought to nest fewer than five times between September and March. To lay their eggs, almost all leatherbacks will return to the beach where they themselves hatched.

When she is ready to nest, a process that will take between one-and-a-half to two hours, a female leatherback will haul herself to shore, usually late at night. Leatherbacks are quick in the water but are extremely slow and cumbersome on land. The turtle slowly drags herself up the beach using her front flippers, stopping when she finds what appears to be a suitable place for the nest. Often turtles will lay their nests in areas that are underwater during high tide, resulting in the drowning of many eggs.

The turtle first uses her flippers to scrape out a body cavity for herself. Then she uses her rear flippers to dig out the egg chamber, which is shaped like a deep flask. It is usually as deep as the rear flippers are long. When the egg chamber is ready, the turtle lays her eggs, which are approximately the size of a billiard ball and have a rubbery shell, which helps to keep them from breaking as they fall into the chamber on top of one another. A leatherback lays from 60 to 90 yolked eggs. On top of



they are small and the time they return to the nesting beaches as adults. Sightings of juvenile turtles are extremely rare, and there is little information on the biology, distribution, or habits of young turtles, although recent research suggests that hatchlings remain in tropical waters until their carapace is a metre long.

Conservation

The leatherback sea turtle is classified as critically endangered by the World Conservation Union and as endangered by the Committee on the Status of Endangered Wildlife in Canada. Leatherbacks have experienced a dramatic population decline of more than 60 per cent since 1982. Because male turtles do not return to land, it is not possible to accurately count them. So scientists determine the population of sea turtles by counting nesting females. Currently, the total number of nesting females is thought to be less than 35 000 worldwide.

The leatherback has also been listed in the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). Canada signed this treaty, as have many of the countries that host nesting or migratory populations of leatherbacks. CITES attempts to ensure that trade in endangered species does not threaten the existence of the turtle. In Canada, leatherback sea turtles, as marine reptiles, fall into the definition of "fish." As such, they are protected by the *Fisheries Act*, which makes it illegal to take or kill "fish" without a permit from Fisheries and Oceans Canada. The *Fisheries Act* can be used to prohibit or restrict directed commercial, recreational, or subsistence fishing activity, but at present there are no regulations on incidental catch of this species. The habitat protection provisions of the *Fisheries Act* are available to protect any marine, estuarine, or freshwater habitat utilized by this species.

Numerous threats to the leatherback have contributed to its endangered status. The mortality rate of hatchlings due to predation is high, though once they reach adult size, leatherbacks have few natural predators. Large sharks or killer whales may attack the turtles at sea, and it is not unusual to see leatherbacks with partially amputated flippers as a result of these

these she lays several yolkless eggs. Some scientists think these "dummy" eggs allow oxygen to continue circulating around the fertile eggs by helping to prevent sand from falling between them.

After the turtle has laid her eggs, she covers the nest with sand and packs it down with her rear flippers. She then uses her front flippers to throw sand around to help disguise the body cavity and the nest before heading back to the ocean. Although her efforts to disguise the nest may be successful, she leaves an unmistakable trail leading from the nesting site with her body and front flippers as she returns to sea.

Leatherbacks hatch approximately 60 to 65 days after the eggs are laid. The hatchlings remain buried in their nest for a time after they have broken out of their eggs. There is enough oxygen within the nest for them to survive. They begin to rise

to the surface of the nest by scrambling around. This causes the sand from the ceiling and walls of the nest to be deposited on the bottom of the nest, slowly raising the turtles to the surface of the beach. The turtles usually emerge from their nests before dawn. The hatchlings typically have a carapace length of 5.1 cm to 6.8 cm. They are black, and the ridges along their carapace are clearly outlined in white.

After they emerge from the nest, the hatchlings look for the brightest spot on the horizon, which is normally the sea reflecting whatever light there is in the sky. Their trip from the nest to the sea is dangerous. On the beach, they are tempting prey for ghost crabs, gulls, crows, vultures, hawks, and coatis, a raccoon-like mammal found in South America. If the hatchlings emerge from a nest that is located on a beach that includes or is near a developed area, such as a resort, they may find that the brightest spot on the horizon is not the sea, but rather the light coming from the development. This causes the hatchlings to become disoriented and to head away from the ocean instead of toward it, increasing their risk of predation and dehydration before successfully reaching water. Once they are in the ocean, the turtles become potential prey for octopi, sharks, and other large fish.

Another mystery surrounding leatherbacks is where hatchlings go between the time



attacks. Jaguars occasionally attack nesting female turtles.

The greatest predator of the leatherback, however, is people. In some countries, humans kill nesting female turtles and harvest leatherback eggs to eat. Because leatherbacks move very slowly on land, they are not able to defend themselves from humans on the nesting beaches. And because the turtles leave a trail to their nests when they make their way back to the water, the nests are easy for egg poachers to locate. Environmental groups in many of the nesting beach regions have implemented "beach watch" programs, where volunteers walk the beaches at night trying to protect the turtles from human predators.

Most threats to the turtles in the ocean also come from humans. Leatherbacks may become entangled in different types of fishing gear. Although many fishers are careful to disentangle the turtles that are accidentally caught in their fishing lines, not all of them do. Entanglement in fishing gear can result in serious injuries to the turtles, including severe cuts and necrosis, or death of the tissue, which could

lead to the loss of a flipper; entanglement can also lead to death by drowning. Unlike other smaller species of sea turtles, leatherbacks are sometimes strong enough to drag large amounts of fishing line and gear to the surface of the water, where they are discovered and released. Unfortunately, this is not always the case.

Leatherbacks are also at risk from marine pollution. There are many recorded cases of leatherbacks dying as a result of eating or becoming entangled in marine debris, such as plastic from sheeting, bags, or deflated balloons, discarded fishing line, and tar balls. Scientists think that leatherbacks may mistake floating plastic for jellyfish and eat it. They are not able to digest the plastic, which can block their gut, causing them to starve.

If scientists hope to curb the dangers the leatherback faces in its long migrations, they need to determine when and where the turtles are at risk. Projects in Nova Scotia, Florida, California, Mexico, Costa Rica, Trinidad, and French Guiana are currently using satellite telemetry to help scientists trace the journeys of leatherbacks.

Resources

Online resources

Canadian Wildlife Services Species at Risk:
www.speciesatrisk.gc.ca

Print resources

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Catalogue number CW69-4/106-2003E
ISBN 0-662-34429-4

Text: Adapted by Paddy Muir from "The Leatherback Turtle" in the Underwater World: Aquatic species at risk series, published by Fisheries and Oceans Canada and the Canadian Wildlife Service, Environment Canada, 2002.
Photos: Nova Scotia Leatherback Turtle Working Group (NSLTWG): L. Hatcher, D. Ivany, M. Godfrey, R. Ganley

The Canadian Wildlife Service

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are species at risk, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

Visit *Hinterland Who's Who* on the Web at www.hww.ca.

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LOGGERHEAD SHRIKE



Photo: John Gavin Cornell

This bird

- which is the size of a robin, hunts like a hawk
- often impales its prey on thorns and barbed wire in order to eat it
- is a species at risk, but scientists do not know why its numbers are dropping
- grows from just over 3 g to more than 45 g in the two weeks after it hatches

Description

The Loggerhead Shrike *Lanius ludovicianus* is a robin-sized bird that hunts like a small hawk, preying on insects and small animals, including small birds. There are 11 subspecies of Loggerhead Shrike in North America, two of which are found in Canada: the Prairie Loggerhead Shrike *Lanius ludovicianus excubitorides* and the Eastern Loggerhead Shrike *Lanius ludovicianus migrans*.

All of the subspecies are quite similar. The back is grey, the wings are black and white, the chest and belly are white, and the tail is black with white strips along the sides. A notable field mark is the “mask,” a black stripe across the eyes and forehead. The birds have a heavy, hooked beak, and a somewhat large head for the size of the body, which likely is the

source of their name—“loggerhead” means “blockhead.” Adult Loggerhead Shrikes measure about 21 cm and weigh about 47.5 g.

A close relative, the Northern Shrike, looks much like the Loggerhead Shrike, although there are several differences. Northern Shrikes, at 25 cm long, are bigger than Loggerhead Shrikes. The black face mask on the Northern Shrike does not usually extend across the forehead above the beak, as it does in the Loggerhead, and adult Northern Shrikes retain faint brownish barring on their underparts. While young Loggerhead Shrikes closely resemble adults during their first year, young Northern Shrikes do not: they have a brown coloration. Finally, the beak of the Northern Shrike is longer than that of the Loggerhead, measuring about half of the front-to-back length of the head.

Signs and sounds

During the spring courtship period, both male and female Loggerhead Shrikes make a range of noises. Their calls are an unmusical series of notes. Other sounds are a variety of shrieks, uttered when the birds are alarmed, or a repeated *tink*, like that made by tapping two pieces of metal together.

Habitat and habits

The Loggerhead Shrike usually is seen perched on utility wires, fence posts, or dead branches protruding from the tops of large trees or shrubs. It flies with a fluttering of wings, followed by a glide, during which the distinctive white patches on its wings and white stripes on the outside edges of its tail are quite visible.

When scouting for prey or hunting, Loggerhead Shrikes usually swoop down from a perch, flutter close to the ground across open areas, and then fly up to land on another perch.

At one time, both subspecies could be seen quite commonly around farms and suburbs, and their presence in an area often was noted because of their habit of impaling their prey on the thorns of small trees or on barbed wire fencing to eat it.

Unique characteristics

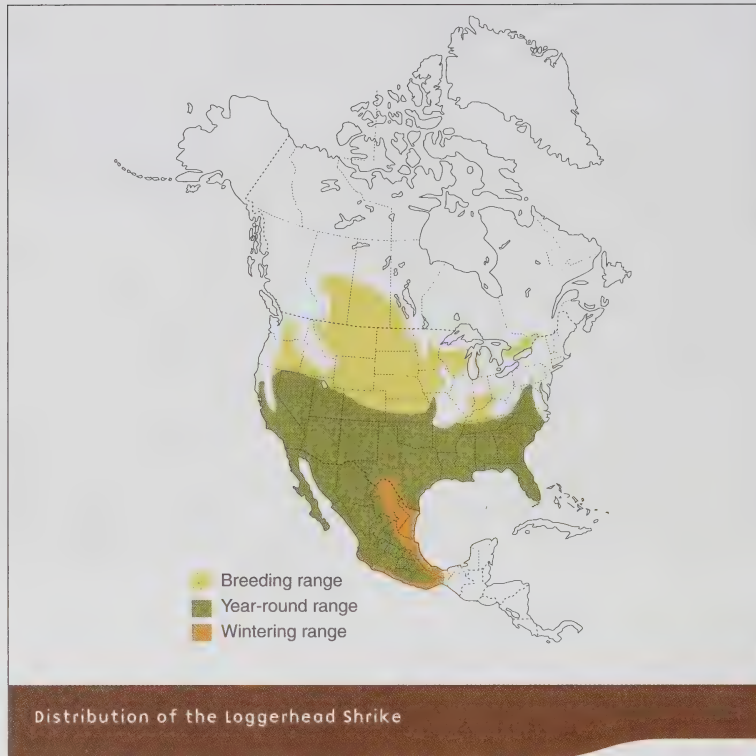
The Loggerhead Shrike kills its vertebrate prey—those with spinal columns—by breaking their necks. Aided by a tomial, or cutting, tooth on the upper beak, the shrike can quickly cut through the spinal cord, partially paralyzing its quarry, making it easier to kill the animal. Then, carrying prey as heavy as its own body in its feet, and smaller prey in its beak, the shrike retires to a spot where it may impale its find on thorns or barbed wire or wedge it into a forked branch in order to eat it. These methods of dealing with its kill are adaptations—they compensate for the fact that the Loggerhead Shrike does not have heavy talons and strong feet to allow it to hold its prey while biting off edible bits.

Range

In the early 1900s, breeding populations of the two subspecies in Canada extended from British Columbia to the Maritimes. At that time, the Eastern Loggerhead Shrike was reported in Nova Scotia, nested in New Brunswick, and was a common breeding bird in the Montreal area and Quebec's Eastern Townships, as well as in the agricultural parts of southern Ontario. The Prairie Loggerhead Shrike occupied grasslands and farmed areas throughout the southern parts of the prairie provinces and was also seen in British Columbia's Okanagan Valley. During the past 100 years, the breeding populations of the two subspecies in Canada have been in a gradual decline.

Today, the Eastern Loggerhead Shrike faces extirpation in Canada—it may soon no longer exist in the wild here. It has disappeared from New Brunswick and Quebec; in Ontario, there are five widely separated locations where a few dozen breeding pairs still can be found; and a small population of about a dozen breeding pairs has been identified in one township in southeastern Manitoba.

The Prairie Loggerhead Shrike is more abundant in prairie Canada, but numbers are in decline in some areas. This subspecies is quickly disappearing from extreme southwestern Manitoba, and it seems to be declining in southeastern Saskatchewan as well. Populations have decreased on the edge



of its range in the parklands of Alberta and western Saskatchewan, but numbers may be more stable in the grasslands of these provinces.

Most Loggerhead Shrikes in the southern part of the bird's range live there year-round. Loggerhead Shrikes that breed in Canada migrate to southern locations in the United States for the winter. Prairie Loggerheads are believed to winter in the southwestern United States and possibly in Mexico. Scientists have collected some information that suggests that Eastern Loggerheads from eastern Canada may winter in Florida, but they must do more work to confirm this possibility.

In the spring, Loggerhead Shrikes migrate in March and April; in the fall, they migrate from September to November. They apparently travel individually and mainly during the night.

If a shrike is observed between the first of May and the first of September in

southern Canada, almost certainly, it is a Loggerhead, because Northern Shrikes, which they resemble, breed far to the north, in the broad transition zone between the boreal forest and the arctic tundra. Shrikes seen from early October until the end of April in southern Canada are probably Northern Shrikes.

Feeding

In the breeding season, Loggerhead Shrikes mainly eat insects, with grasshoppers and beetles being the prominent items. When insects are harder to find, the shrikes consume mice, small birds, small snakes, lizards, or frogs.

Breeding

Loggerhead Shrikes return to Canada in April and early May to breed. They begin to breed when they are a year old. While they are mainly monogamous, they will mate with other shrikes, and occasionally females will desert males after the young of the first brood have left the nest,

raising a second brood nearby with another male. Highly territorial, the pairs establish breeding areas where all activities—foraging, mating, and raising young—take place. Instead of fighting over territorial boundaries once they have been set, Loggerhead Shrikes usually threaten neighbours through the sounds they make or through a bowing behaviour called a “flutter display.”

For their breeding areas, Loggerhead Shrikes prefer grassy pastures that are well-grazed or mowed, but not bare, where they can spot prey easily in the sparse cover; shrubs or small trees, preferably thorny ones like hawthorn or thorny buffaloberry, for nesting and anchoring prey; and high perches in the form of dead branches, or utility wires, from which they can survey their territory and hunt.

There has been much debate about whether Loggerhead Shrikes return to the same nest sites year after year. Some nest sites appear particularly desirable—there are occupied repeatedly. In other cases, scientists have found that birds change sites from one year to the next.

Males and females help find the nest site, and they both gather nest material. The female usually builds the nest alone, fashioning a well-made structure 15 to 20 cm in diameter, thickly woven of dead plant material so that it possesses good insulating qualities against the cold rain and unseasonable snowstorms of early spring. The nest is usually in dense cover 1 to 2.5 m above the ground but is occasionally placed several metres high. It is usually built in six to 11 days.

Egg-laying begins in late April in the east and mid- to late May in the west. The usual number of eggs is five to seven. The female begins to incubate, or warm, the eggs when she has almost finished laying. During this time, she is fed by the male. The young hatch about 16 days after incubation begins.

When they hatch, the chicks are altricial—naked, blind, and helpless. The parents work hard to keep them warm and fed. During one hour watching a nest with eight nestlings, scientists saw one or the other adult bring a grass-

hopper to the nest every four minutes. Within two weeks, the young, which are about 3.2 g when they hatch, are almost as heavy as their 47-g parents.

The young leave the nest when they are about 17 to 20 days old. They move into nearby branches, but return to the nest to be brooded, or warmed by their mother, at night. Young birds are fed by the adults for two to three weeks after they have fledged, or left the nest, during which time they learn to hunt and become increasingly self-sufficient. Soon after, the family group breaks up, and by early September the adults and young begin their migration to the wintering grounds. During migration, and on the wintering grounds, these two subspecies may mingle with other resident, non-migratory subspecies of Loggerhead Shrikes.

Conservation

The Loggerhead Shrike is a useful and interesting bird. It consumes large numbers of grasshoppers, field mice, and meadow voles, all major pests of agricultural crops.

Throughout its North American range, the Loggerhead Shrike has aroused serious concern because of its declining numbers. Scientists estimate that fewer than 50 pairs of Eastern Loggerhead Shrikes breed in Canada. Because Prairie Loggerhead Shrikes are thinly distributed over a large area, scientists find it difficult to calculate how many there are. However, they believe that fewer Prairie Loggerhead Shrikes live in prairie Canada today than in the early 1990s, when the number of pairs was estimated at several thousand. The Eastern Loggerhead Shrike has been assessed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and is listed under the federal Species at Risk Act (SARA). The Prairie Loggerhead Shrike has been assessed as threatened by COSEWIC and is undergoing consultations to determine if it should be listed under SARA. (A species is considered endangered when it is facing imminent disappearance from Canada or extinction. A threatened species is one that is likely to become endangered if nothing is done to reverse the factors limiting its survival in Canada.)

It is not certain why the number of Loggerhead Shrikes in Canada has been in such a continued decline, since many young hatch and appear to be successfully raised each year. However, it is possible that a large number of birds are lost after they leave the nest; scientists have not yet determined how many or why birds may die at this time.

The Loggerhead Shrike has a number of predators, among them Black-billed Magpies, Common Crows, bull snakes, feral cats, and prairie long-tailed weasels. However, it is believed that long-term changes in land use by humans on breeding and wintering ranges probably have contributed most to the decline. In western Canada, large areas that were formerly native grassland or pasture now support crops or have reverted to forest or scrubland, in part because wild fires that once periodically swept the grasslands, burning young aspens and keeping them from supplanting the wild grasses, now are quickly extinguished. In eastern Canada, land-use practices have changed, family farming has declined, and suburban sprawl is on the rise. Former grasslands are reverting to shrublands, and forests and essential habitat are becoming fragmented and smaller. Remaining habitat often is along roadsides, where shrikes frequently are victims of collisions with vehicles.

A number of efforts are under way to protect existing habitat and establish new habitat for these birds. In 1993, a national Loggerhead Shrike Recovery Team was established, which later became two groups, responsible for the Eastern Loggerhead Shrike Recovery Program and the Prairie Loggerhead Shrike Recovery Program. Members of the groups include representatives from the Canadian Wildlife Service, provincial wildlife agencies, a number of environmental nongovernment organizations, the Canadian Cattlemen's Association, some provincial cattlemen's associations, several universities, and a zoo, as well as a number of landowners. See the end of this fact sheet for contact information.

Recovery plans are in place for the Eastern and Prairie Loggerhead Shrike. These plans are blueprints for recovery actions. Research on Loggerhead Shrike

populations in Canada increases each year. Activities include population monitoring, banding (placing a numbered aluminum band around the leg of a bird), DNA studies, and the establishment of a captive population to produce offspring for future releases when the causes of the decline are better understood. In addition, Loggerhead Shrike Recovery Action Groups are being established to coordinate landowner stewardship efforts; in eastern Canada, in particular, almost every known breeding pair is found on private property.

A National Accord for the Recovery of Species at Risk, signed by the federal, provincial, and territorial governments, commits the parties to working together to ensure that no endangered or threatened species in Canada will become extirpated or extinct. The signatories to the Accord must ensure that they have legislation in place to allow them to fulfil their commitment. If efforts to help the Loggerhead Shrike population to increase in Canada are to succeed, additional support from governments, groups, and individuals is essential—to protect existing and to establish new habitat.

Resources

Online resources

Canadian Cattlemen's Association—The Eastern Loggerhead Shrike:
www.cattle.ca/stewardship/shrike.html

Canadian Wildlife Service Species at Risk:
www.speciesatrisk.gc.ca

Wildlife Preservation Trust Canada:
www.wptc.org/Shrike.html

Print resources

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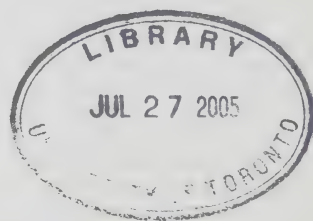
Recovery efforts

Recovery efforts for the Loggerhead Shrike are shared by two groups responsible for the Eastern Loggerhead Shrike Recovery Program and the Prairie Loggerhead Shrike Recovery Program. Anyone seeking additional information, or wanting to report sightings of birds or nests, participate in habitat stewardship activities on their own properties, or volunteer for stewardship activities may contact the appropriate group:

- Eastern Loggerhead Shrike Recovery Program: toll-free (866) 833-8888
- Prairie Loggerhead Shrike Recovery Program: (306) 975-4087

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Catalogue number CW69-4/87-2003E
ISBN 0-662-34248-8
Text: E. S. Telfer
Revision: Robert Wenting, Andrew Didiuk, 2003
Editing: Maureen Kavanagh, 2005
Photo: John Gavin, Cornell Lab of Ornithology



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are species at risk, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

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The Facts

- Is renowned for its hunting and territorial ways.
- chick can swim right away, but spends some time on the water's surface to rest, conserve heat, and avoid predators.
- has only bones that are solid, rather than hollow like "house" rather than "hollow" birds, which aids its diving ability.
- can stay under water for almost 3 minutes and dive to depths of 10 m.
- may have to run as far as several hundred metres on the surface of the water on a calm day, before gaining enough speed to take off.

Description

Loons are water birds like ducks, geese, and grebes, but they are classified separately by scientists. The five species are Red-throated Loon *Gavia stellata*, Pacific Loon *Gavia pacifica*, Arctic Loon *Gavia arctica*, Yellow-billed Loon *Gavia adamsii*, and Common Loon *Gavia immer*. The Common Loon is the species best known to most of us, as its breeding range lies across most of Canada.

The Common Loon in summer is very striking with its black-and-white checkered back, glossy black head, white belly and wing lining, and characteristic white necklace around the throat. All loons have greyish feathers in the winter, and immature birds tend to resemble adult birds in winter plumage. The white feathers of

the belly and wing linings are present year-round.

Loons' habit of swimming low in the water helps to distinguish them from other waterbirds, such as ducks and geese. Loons most resemble the grebes, but can be identified by their larger size, thicker necks, and longer bills. In flight, loons can be recognized by their humpbacked profile, with head and neck held low and feet pressed back towards the body and projecting beyond the tail.

Males and females look the same, although males are generally larger. Adults are large-bodied, weighing from 2.7 to over 6.3 kg and measuring almost a metre from bill tip to outstretched feet. The bill is quite large, averaging 75 mm in length, and is black in colour throughout the year.

The skeleton and muscular system are designed for swimming and diving. Loons are streamlined. Their legs are placed far back on their bodies, allowing for excellent movement in water but making them ungainly on land. Their heads can be held directly in line with their necks during diving to reduce drag, and the legs have powerful muscles for swimming.

The small Red-throated Loon takes its name from a triangular patch of chestnut-red on its throat. Its head and neck are soft slate-grey, and the back of its neck is streaked with fine white lines. Wings and back are brownish grey with little marking. Its underparts are white.

The Pacific Loon is the other small loon that breeds in northern Canada. The crown and hind neck of this bird are pearl-grey, and the underneck and throat are black. A series of white lines streaks the sides of the upper breast, and the underparts are silvery white. White squares arranged in lines form four obvious patterns on the back of the wings and upper back.

The Arctic Loon is only an occasional nonbreeding visitor to British Columbia. In the past, the Arctic Loon and the Pacific Loon were grouped together under the name "Arctic Loon."

The Yellow-billed Loon closely resembles the Common Loon, although it is usually larger. It may be distinguished only by its yellow-white bill, the lower half of which angles up.

Signs and sounds

Perhaps one of the most fascinating things about Common Loons is their haunting and variable voice. Loons are most vocal from mid-May to mid-June. They have four distinct calls, which they use in varying combinations to communicate with their families and other loons. These are the tremolo, wail, yodel, and hoot. The tremolo sounds like a crazy laugh and is used for a variety of purposes, such as to signal alarm or worry and to denote annoyance or greeting.

The wail is one of the loveliest of loon calls. It is used frequently during social interactions between loons and may be used to regain contact with a mate during night chorusing and in answering other loon tremolos.

The yodel is given only by the male. It is a long, rising call with repetitive notes in the middle and can last up to six seconds. It is used by the male to defend territory and can be stimulated by another male entering a loon's territory. Studies of recordings have shown that the yodel is different for each bird and can be used to identify individual loons.

The hoot is a one-note call that sounds more like *boo*. It is mainly used by family members to locate each other and check on their well-being.

Habitat and habits

Loons have long been considered by many North Americans as beautiful and special, symbolizing wilderness and solitude. Many cottage-goers, campers, and vacationers would feel their trip was incomplete without seeing a loon or listening to its haunting call.

Hunting, feeding, resting, preening, and caring for young are the loon's main activities. The bird spends long rest periods motionless on the water. It may rouse itself to stretch a leg or wing at intervals, occasionally comically wagging a foot. When swimming on top of the water it



Left: swimming profile; centre: profile of alarmed loon, which may sink slowly into the water, leaving only the neck and head above water; right: flight profile

will sit erect with neck slightly curved. The loon will peer underwater, moving its head from side to side to locate prey. It then aims and dives quickly. It will stay underwater for almost a minute and can dive to depths of 80 m. During the dive, feathers are compressed and air is forced from between the feathers and from the air sacs in the body. Loss of air from the air sacs also allows the loon to quietly sink below the water surface to avoid danger.

The Common Loon spends most of the time on water and has to pull itself onto land to nest. It generally moves one foot at a time to walk, shuffling along with its breast close to the ground. The loon returns to the water by sliding in along its breast and belly. At night, it sleeps over deeper water, away from land for protection from predators.

Sometimes loons gather into small groups in the summer. In September, group feeding is quite common as loons gather on larger lakes while migrating. Loons are also usually found in groups on the wintering grounds.

Loon chicks can swim right away but spend some time on their parents' backs to rest, conserve heat, and avoid predators such as large carnivorous fish, snapping turtles, gulls, eagles, and crows.

Many bones of the loon's body are solid, rather than hollow like other birds', which aids in diving ability. During dives, the large webbed feet provide all of the propulsion and the wings are held tight unless they are used to help make sharp turns while chasing prey.

The adaptations that make the loon such an efficient diver also make it heavy and slow to take wing. To take off from a lake, the loon runs along the surface into the

wind. The distance needed to gain flight depends on wind speed; in calm times the bird may run as far as several hundred metres before it gains enough speed to take off. Once in the air, the loon can travel swiftly. Its relatively small wingspan (130 to 140 cm) carries it at average speeds of 120 km per hour during migration. The wings beat quickly to carry the large body and have a high degree of curvature to provide lift.

Range

All five species of loons migrate to warmer areas around the Gulf of Mexico and on the east and west coasts of North America for the nonbreeding season, and return to northern lakes to breed when the ice melts in spring.

The Common Loon breeds in most of Canada. It spends the nonbreeding season along the Pacific and Atlantic coasts of North America, from Alaska and the island of Newfoundland in the north to Mexico in the south.

The breeding range of the Ruby-throated Loon includes northern Canada. It takes off from water more readily than the other loons, so is able to nest on the smaller tundra ponds. The Red-throated Loon may be seen in both eastern and western Canada during migration, but it is more common in the Great Lakes region. It spends the nonbreeding season off both coasts.

The Pacific Loon also breeds in northern Canada. It congregates in large numbers off the west coast in winter. In recent years, numerous migrating Pacific Loons have been seen in autumn in west-central Alberta.

The Arctic Loon is only an occasional nonbreeding visitor to British Columbia.

The Yellow-billed Loon breeds from Great Slave Lake northward across the western Arctic. It winters on northern seas and is not likely to be seen in settled parts of Canada.

Feeding

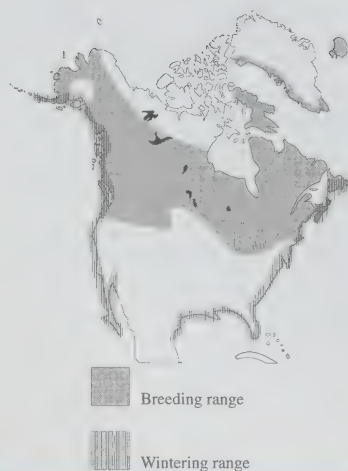
Loons are predators; their diet in summer consists of fish, crayfish, frogs, snails, salamanders, and leeches. Adult loons prefer fish to other food, and seem to favour perch, suckers, catfish, sunfish, smelt, and minnows.

Adult loons may fly to different lakes to feed.

Breeding

Loons arrive in pairs on northern lakes in the spring as soon as the ice thaws. They are solitary nesters. Small lakes, generally those between 5 and 50 ha, can accommodate one pair of loons. Larger lakes may have more than one pair of breeding loons, with each pair occupying a bay or section of the lake. Until recently, loons were thought to mate for life. Banding studies have shown that loons will sometimes switch mates after a failed nesting attempt, even between nestings in the same season. Courtship and mating are a quiet time, with the pair swimming and making short dives together. Eventually the male leads the female to a suitable spot on land for mating. Nest building then begins.

Loons build their nests close to the water, with the best sites being completely surrounded by water, such as on an island, a muskrat house, a half-submerged log, or a sedge mat—a clump of grass-like water plants. Generally the birds can slip directly from the nest to water. The same sites are often used from year to year. Loons will use whatever materials are on hand to build their nests. Researchers have found tree needles, leaves, grass, moss, and other vegetation under loon eggs. If material is not handy, loons will lay their eggs directly on the mud or rock. Sometimes clumps of mud and vegetation are collected from the lake bottom to build the nest. Both the male and female help in nest building and with incubation, or warming the eggs, which lasts until hatching, usually 26 to 31 days. If the eggs are lost, the pair may re-nest, often in the same general location.



Distribution of the Common Loon

Usually two eggs are laid in June, and towards the end of the month loon chicks covered in brown-black down appear on the water. Loon chicks can swim right away, but spend some time on their parents' backs to rest, conserve heat, and avoid predators such as large carnivorous fish, snapping turtles, gulls, eagles, and crows. After their first day or two in the water, the chicks do not return to the nest.

Chicks are fed exclusively by their parents for the first few weeks of life, and up until eight weeks of age the adults are with them most of the time, providing most food. After this time the chicks begin to dive for some of their own food and by 11 or 12 weeks of age, the chicks are providing almost all of their own food and may be able to fly. Chicks are fed small food items early in their life, including snails, small fish, crayfish, minnows, and some aquatic vegetation. As they grow, they require more protein, and usually are fed more fish, if available.

The life expectancy of the loon may be 15 to 30 years.

Conservation

All loons are protected by federal law and may not be hunted. Although loons still nest in large numbers across Canada, recent studies have shown cause for concern about low breeding success, especially of

the Common Loon. Because this loon nests in populated areas of Canada and the United States, it is susceptible to the effects of pollution, development, and disturbance. Historic data show that loons have abandoned some of their former nesting areas in the southern parts of Canada and the northern areas of the central United States. Loss of breeding habitat and disturbance are probably the main causes of this reduction in the original breeding range. Loss of habitat results from lake-shore development and spills of oil and other pollutants. Physical interference with nests or young and increased boat wake on lakes, which may swamp or destroy nests, also cause loons to abandon some nesting sites.

Recent studies have indicated that loon nesting success and survival of young may decrease with increased lake acidity, the result of acid rain. Acidity can result in decreases in fish and other foods, causing loon chicks on very acid lakes to starve. Acidification of lakes may also increase the rate of methylmercury production by microbes in lake sediments and water, resulting in higher concentrations of mercury in the food chain.

A significant proportion of loons found dead in the United States and Canada have high concentrations of mercury in their tissues. Loon die-offs in nonbreeding habitats off the Gulf Coast of Florida have been linked to poor body condition and elevated mercury concentrations. Canadian research has demonstrated that loons nesting near industrial sources of mercury pollution occupy few potential territories and lay few eggs, resulting in poor reproductive success. Increased methylmercury concentrations in fish, the loon's main food source, is the result of environmental mercury pollution, acidification, and flooding of forested land for hydroelectric development. These activities pose a threat to the health and reproductive success of loons in many locations throughout their range.

Loons are also dying of lead poisoning after eating fish with lead sinkers, and possibly after picking up discarded sinkers from lake bottoms. The lead is partially dissolved in the loon's gizzard, or second part of the bird's stomach, then absorbed into the blood and body tissues. The absorbed lead causes nerve, kidney, and other tissue damage. North American studies indicate

that a significant proportion of adult loon deaths on the breeding grounds is attributable to lead poisoning from ingestion of sinkers. Abandoned or unattended fishing line and hooks also cause loon injury and death.

To protect the loons on lakes we visit, boats should be kept well away from swimming birds, particularly when they are with chicks that are too young to dive or fly. Some shoreline areas should be left undisturbed to accommodate loon nests, and boaters passing these areas should travel at speeds that do not cause wash. Seaplanes should come and go as far from nesting areas as possible, taxiing to other parts of the lake. Anglers have the responsibility of using non-lead sinkers and of ensuring that no hooks or lines are left unattended or abandoned.

If you are interested in learning more about loons or becoming involved in loon conservation, contact:

The Canadian Lakes Loon Survey
Bird Studies Canada
P.O. Box 160
Port Rowan, Ontario
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N0E 1M0
Phone: (519) 586-3531
E-mail: aqsurvey@bsc-eoc.org
Web: www.bsc-eoc.org

Resources

Online resources

Cornell University Laboratory of Ornithology:
www.birds.cornell.edu

Print resources

BENT, A.C. 1963. Life histories of North American diving birds. Dover Publications, Inc., New York.

DENNIS, Roy. 1993. Loons. Voyageur Press, Stillwater, Minnesota.

GODFREY, W. 1986. The birds of Canada. Revised edition. National Museum of Natural Sciences, Ottawa.

KLEIN, T. 1989. Loon magic. Northwood Press, Inc., Minocqua, Wisconsin.

MCINTYRE, J.W. 1988. The Common Loon: Spirit of northern lakes. University of Minnesota Press, Minneapolis.

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Catalogue number CW69-4/4-2003E
ISBN 0-662-34996-2
Text: Jane Ashenden
Revision: Mary Wyndham and Tony Scheuhammer, 1994

The Canadian Wildlife Service

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are species at risk, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

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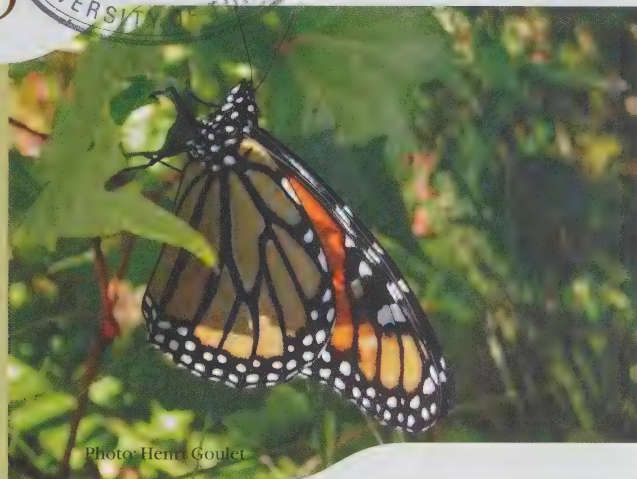


Photo: Henri Goulet

The monarch

- is probably the most widely recognized of all North American butterflies
- migrates thousands of kilometers in vast numbers twice a year, a feat not performed by any other insect on earth
- has been observed flying more than 1 km above the ground
- is highly resistant to both its larval and adult forms, probably a warning to potential predators that it is poisonous
- has recovered from population losses approaching 90 percent in the past half century and is able to rebound from the population levels in which environmental factors are now pushing it

Monarchs are wide-ranging and powerful fliers. They are able to seek out even the smallest patches of milkweed, including plants growing in city gardens and along busy highways. Not limited by human disruption, monarchs will breed readily on milkweeds in areas where there is a high level of human activity, as long as the plants are healthy.

The monarch has also proved itself to be a highly adaptive species. In the last 150 years there has been a major shift in the North American distribution of the eastern population. This appears to have resulted from the widespread conversion of the natural midwestern prairie to cropland, a process that destroyed much of the native prairie plants and animals, including about 22 species of milkweeds. At the same time, many areas of the deciduous forests of eastern North America were cleared for farming, allowing the rapid spread and increasing abundance of the common milkweed in the cleared lands. The cleared portions of the eastern deciduous forest region correspond to the principal breeding area of the eastern population of the monarch today.

During migration, monarchs conserve energy by riding columns of rising warm air, which greatly reduces the need to flap their wings for sustained periods. They frequently reach high altitudes where strong

Description

With its bright colours, large size, and slow powerful flight, the monarch *Danaus plexippus* is probably the most widely recognized of all North American butterflies. The bright orange wings, which span 93 to 105 mm, have a thick black border containing two rows of white spots. Male monarchs also have two highly visible black spots on their hind wings. The bands of black on the wing veins are wider on the female monarch.

At first glance the monarch may be confused with the viceroy *Limnitis archippus*, which has a similar appearance. The viceroy is smaller, with a wingspan of 70 to

75 mm. The viceroy also has a black cross-wise stripe that crosses the bottom of its hind wings.

Habitat and habits

Monarchs can exist wherever milkweeds grow. Monarch larvae, or caterpillars, feed exclusively on milkweed leaves. In eastern Canada, the main plant on which monarchs develop is the common milkweed *Asclepias syriaca*. Common milkweed grows widely on abandoned farmlands, along roadsides, and in other open areas where weedy species thrive. In western Canada, showy milkweed *Asclepias speciosa* is the primary larval host plant.



animal unwise enough to eat either an adult or a caterpillar monarch will probably become ill and suffer severe vomiting.

Range

The monarch is widely distributed across North America, from Central America northwards to southern Canada, and from the Atlantic to the Pacific coasts. Within Canada, the monarch has been recorded in all 10 provinces and in the Northwest Territories.

Three geographically distinct populations—eastern, western, and Central American—make up the total North American range of the species. Each of these populations has a distinct migratory pattern.

The eastern population is the largest of the three and includes all monarchs east of the Rocky Mountains in the United States and Canada. The eastern population accounts for over 90 percent of the Canadian distribution of the species. The current annual breeding range of the eastern population extends from the Gulf Coast states northwards to southern Canada, and from the Great Plains states and Prairie provinces eastwards to the Atlantic coast of the United States and the Maritime provinces.

prevailing winds speed their flight. Glider pilots have observed migrating monarchs flying more than a kilometre above the ground.

In the fall, monarchs migrate thousands of kilometres, travelling from Canada to Mexico. In Canada, they can be seen in southern Ontario, especially in such areas as Point Pelee National Park, on the shores of Lake Erie, and Presqu'île Provincial Park, on Lake Ontario, where they cluster together on trees to form overnight roosts before crossing the lakes. These clusters can be miniature versions of the dense colonies they form at the overwintering sites. These overnight roosts may contain a few hundred to several thousand individuals. Monarchs usually form clusters in the same areas year after year.

Monarchs migrating south in the fall build up in large concentrations along the north shores of Lake Ontario and Lake Erie. Their apparent reluctance to fly over large bodies of water is probably the reason they fly southwestward following the shoreline. This inevitably results in large concentrations of monarchs accumulating on penin-

sulas jutting out into lakes where they eventually have to move southward over open water.

Unique characteristics

The monarch is unique among North American butterflies in performing an annual two-way migration in vast numbers from one area of the continent to another. Probably no other insect among the millions of species on earth performs a similar migration. Scientists still have much to learn about how individual monarchs are able to return each year to overwintering sites and breeding grounds they have never seen. The many millions of monarchs blanketing forested mountain slopes in Mexico is a spectacle of tremendous natural beauty and a unique phenomenon produced nowhere else on earth.

Unlike most butterfly larvae, which are coloured to blend in with their surroundings, monarch larvae are brightly coloured. Their conspicuous appearance serves as a warning to potential predators that the monarchs are poisonous. This is because they ingest poisonous juices from the milkweed plants on which they hatch. Any

The entire eastern population migrates to about 12 overwintering sites in central Mexico, where the butterflies congregate in vast numbers. These sites, which are specialized high-altitude ecosystems, are all located within a small area of approximately 800 square kilometres and occur only in oyamel fir forests.

Migrating eastern monarchs reach the overwintering sites from November to late December. They form dense groupings of tens of millions of individuals and remain relatively inactive over the winter months. When the colonies break up in March and early April, the butterflies migrate north to the Gulf Coast of the United States, where the females lay their eggs on milkweeds. Two or three generations, or broods, of monarchs are produced here in the spring, and it is these offspring of the overwintering generation that continue the migration to the northern breeding range. This step-by-step continued migration is necessary since milkweeds die out in the Gulf Coast region in June. Continuing north allows monarchs to exploit the milkweed resources of central and northeastern North America, enabling the species to produce

up to three additional summer generations. These generations are critical to rebuild the population losses at the overwintering sites.

Eastern monarchs reach Canada each year, although numbers can vary dramatically from year to year, depending on the success of overwintering in Mexico and the size of spring generations produced annually in the Gulf Coast states during the spring migration. The first returning migrants reach southern Canada near the end of May and the first week of June.

The western population includes all monarchs found west of the Rocky Mountains in the United States and Canada. The current annual breeding range of western monarchs extends from Arizona and New Mexico to southern British Columbia and from the Rocky Mountains westward to the Pacific coast. Western monarchs reach British Columbia only in summers with extended periods of warm, sunny weather in the Pacific northwest. During such favourable years, breeding occurs in scattered locations across the province, particularly in the Okanagan Valley and along the Fraser River.

Monarchs of the western population undertake an annual migration much like that of the eastern population. They overwinter at numerous sites along the nearly 1 000 kilometres of the California coast to the Mexican border. More than 200 overwintering sites have been recorded in California, and individual colonies may support from dozens to tens of thousands of individuals. The vast majority of these overwintering sites are associated with stands of non-native Australian eucalyptus trees.

The annual southward migration of the eastern and western monarch populations begins in Canada in early August and continues through to mid-October. When monarchs are migrating, they do not reproduce. They avidly seek nectar from flowers to fuel their migration and to build up a critical fat reserve to sustain them through the winter. This stored fat is also essential for their northward migration in the spring, when nectar sources are not available.

The Central American monarch population occurs in Guatemala, El Salvador, Honduras, Belize, Nicaragua, Costa Rica, Panama, and southern Mexico. Unlike the eastern and western populations, the Central American population migrates only 10 to 100 km between highland and lowland areas, according to dry and wet seasonal condi-



tions. This monarch population reproduces throughout the year.

Monarchs have been introduced into Australia, South America, Hawaii, and several other Pacific islands. Migrating monarchs occasionally reach Europe and South America, probably aided by ships.

Feeding

Adult monarchs will feed on the nectar of many flowers, but they breed only where milkweeds occur. The leaves of the milkweed are the sole food of the larvae, or caterpillars, that emerge from the eggs.

Breeding

Like all butterflies and moths, monarchs have a life cycle with four stages of development: egg, larva—or caterpillar—pupa, and adult. These changes in form are also known as metamorphosis.

Mating between adult butterflies occurs throughout the day, with more mating being observed in the mid- to late afternoon. Females lay their fertilized eggs on the undersides of milkweed leaves. They identify the milkweed by scraping the leaf surface with their front legs and “smelling” the plant juices with their antennae, or feelers. A single female may lay as many as 400 eggs. The eggs are laid singly on the leaves, often on different leaves of the same plant and on nearby plants. As a result, dense collections of larvae can occur in large stands of milkweed.

The eggs hatch in three to 12 days, depending on temperature. The larvae feed on the leaves for about two weeks, developing into plump caterpillars with vivid black, yellow, and white stripes. The caterpillar

moult, or sheds its skin, up to four times as it grows to a length of about 5 cm. In preparation for the third stage, the caterpillar attaches itself to a suitable twig with its head facing downwards. It sheds its skin one last time and forms a hard protective casing. This transformation into a pupa, or chrysalis, takes a few hours.

The completed pupa looks like a shiny jade-green vase with a band of golden speckles. Packed tightly inside, the caterpillar undergoes a miraculous transformation, emerging about two weeks later as the beautiful butterfly. A few hours before the adult emerges, the pupa becomes completely transparent, revealing the new butterfly inside. When the butterfly first emerges, its wings are small, thick, and leathery, and its body is full of fluid that it pumps into the wings. Much like inflating a balloon, this process causes the wings to expand. As the wings dry, they stiffen until the butterfly is ready for its first flight.

In southern Canada, eastern monarchs produce two to three generations, or broods, each year from June to September. Development from egg to adult butterfly takes 20 to 45 days, depending on the day length, the temperature, and the availability and quality of the food plant. The average is about 30 days.

Monarchs that emerge in late summer migrate. If they survive all winter their life span is six to nine months. They do not mature sexually before they migrate and do not breed during the winter period.

Weather conditions are the principal factor in determining the size and breeding success of the monarch population. Cold, wet, and overcast conditions in the spring and summer breeding range can prevent adult butterflies from dispersing, mating, laying eggs, and feeding, since they require warm and sunny conditions to be active. Hot, dry summers with periods of drought are also harmful since these conditions reduce the quality and availability of larval food and nectar sources for the adults.

Conservation

Based on estimates of the number of butterflies overwintering in Mexico and California, the eastern monarch population currently numbers in the tens of millions, while the smaller western population numbers in the millions. Historical data indicates that the size of both populations

fluctuates regularly, and often dramatically, as a result of winter storm mortality, poor breeding conditions, predation, parasites, disease, and other pressures in combination with each other. In the past, both populations have suffered losses approaching 90 percent but have recovered because the surviving 10 percent experienced excellent conditions in the breeding range.

While a fluctuating population size appears to be the norm for monarchs, the eastern population is now suffering consistently higher levels of mortality. This may be reducing the population size to a level from which it cannot recover itself. The main reason for the decline in monarch populations has been the periodic natural disasters at the Mexican overwintering sites. Some sites may sustain losses of anywhere from 30 to 90 percent during winter storms. Human alteration of the habitat, particularly the opening of forests by logging, has reduced the protective effect of the forest canopy. This has greatly increased the negative effects of winter storms and has made the overwintering monarchs more susceptible to predation from birds and mammals.

In the past, these disasters have been counterbalanced by the increase in breeding habitat in eastern North America. However, widespread and increasing use of herbicides throughout North America may also result in dwindling fall migrations in the next few years, due to the eradication of host plants for larvae and nectar sources for adults in the breeding range. Without effective protection of the Mexican overwintering sites as well as protection of breeding habitats and nectar sources along migration routes in Canada and the United States, the eastern population of the monarch may become extirpated in North America early this century.

“Extirpated” means that a species no longer exists in the wild in a particular location although it may occur elsewhere.

Other causes of population decline for the eastern population include predation at the overwintering sites by the Black-headed Grosbeak and Black-backed Oriole, both of which can circumvent the monarch's toxic properties and feed extensively on the roosting butterflies. The western population is threatened by real estate development along the California coast, active programs to eliminate introduced eucalyptus trees, and a recently discovered disease.

Various scientists have recognized the annual migration of the monarch in North America as an endangered phenomenon. In 1983 the spectacular winter roosts in both Mexico and California were designated as threatened phenomena by the World Conservation Union. This was the first such designation in the history of international conservation. The new status was created to recognize the fact that the millions of monarchs migrating and overwintering in North America each year are imperilled, while acknowledging that the species as a whole is not in danger of extinction. “Extinct” means that a species no longer exists.

In October 1995, Point Pelee, Long Point, and Prince Edward Point in southern Ontario were designated as monarch reserves as part of an international agreement with Mexico. Little protection currently exists elsewhere in Canada with regard to the monarch and its habitats. At present there is abundant habitat for monarchs in southern Ontario and Quebec,

but this habitat can easily be lost if abandoned farms are put into active production, converted into housing estates, or become overgrown by trees and shrubs. Programs to eliminate milkweed can also eliminate habitat.

Resources

Online resources

Monarch Lab, University of Minnesota:
www.monarchlab.org

Monarch Butterfly Hub:
www.projectlinks.org/monarch

World Wildlife Fund, Mexico:
www.wwf.org.mx/monarch_conservation.php

Printed resources

CROLLA, J.P., and LAFONTAINE, J.D. 1996. Status Report on the Monarch Butterfly (*Danaus plexippus*) in Canada. Submitted to Canadian Wildlife Service, Ottawa.

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Catalogue number CW69-4/105-2003E
ISBN 0-662-34365-4
Text: Paddy Muir and Don Lafontaine

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MURRES



These birds

- can dive almost the length of a football field straight down below the surface of the sea
- travel up to 6 000 km a year when they migrate
- leap from cliffs more than 500 m high with half-grown wings at three weeks of age
- can live for 25 years
- as chicks, swim the first 1 000 km of their migration journey

Description

There are two species of murre: the Common Murre *Uria aalge* and the Thick-billed Murre *Uria lomvia*. They and their close relatives—razorbills, dovekies, guillemots, and puffins—are members of a group of black and white, penguin-shaped seabirds called auks.

The two species look much alike. In summer they are black on the back, neck, and upper breast and glossy white below—they look as if they are wearing elegant dinner jackets. In winter, the throat, cheeks, and upper breast turn white. In summer, the Common Murre's chocolate-coloured back is lighter than the Thick-billed Murre's darker and shinier feathers; in winter, the Common Murre shows a white streak behind the eye.

Both species have sharp, dagger-like bills that are somewhat flattened from side to

side; however, as the name suggests, the Thick-billed Murre's beak is shorter and stouter than the Common Murre's. The beak is black, and in summer the two species can be told apart by the distinct white line along the cutting edge of the top half of the Thick-billed Murre's beak (see illustration on page 2).

Adult murres weigh about 1 kg and are about 30 cm tall.

Stunning sounds

Murre colonies are very noisy places, as neighbouring birds quarrel in deep, growling guttural *aargh* calls, and mates greet each other in rattling crescendos. Adults keep track of their own chicks on crowded ledges by recognizing their peeping calls, which the chicks first make from within the shell just before hatching. Their calls become more strident *wee-wee* notes as the chicks prepare to leave the colony, and chicks

and adults keep in touch by calling to each other at sea as they depart on their swimming migration.

Habitat and habits

These seabirds are found year-round off the Atlantic and Pacific coasts of Canada. The Common Murre is generally present in waters that are free of ice, whereas the Thick-billed Murre lives almost year-round in colder areas where there is at least some floating pack ice.

Murres are not very good fliers or walkers. Their wings are smaller than those of any other flying bird of their size, and they have to flap very fast to take off, taxiing across the surface of the water and often bouncing off the tops of waves before getting airborne. However, they are fast fliers once in the air, where they travel at about 75 km per hour.

Because their tails are very short, murres use their feet as rudders for flying, spreading them apart for complicated manoeuvres. Murres cannot turn sharply and may have difficulty landing at their rocky breeding colonies on stormy days, sometimes bumping into a cliff and circling back to make several attempts before successfully landing on a ledge.

Murres are awkward on land because their feet are placed far back on their



bodies. They either shuffle along slowly on their haunches or patter erratically with wings flapping wildly.

However, mures do not rely heavily on flying and walking, because they spend eight or nine months of the year continuously at sea, coming ashore only to breed. Swimming and diving are the mures' specialties.

Unique characteristics

Unlike many ducks, which propel themselves underwater with their feet, mures dive by flapping their half-open wings, as if flying underwater. Their wings must be relatively short to do this, because water has much more resistance than air and takes much more effort to move through. To support all this flapping, mures have very large breast muscles, which make up a quarter of their body weight. If mures were any larger, their wings would be unable to propel them through both air and water. The extinct Great Auk was much larger than a murre, weighing up to 5 kg, and although its small wings made it a superb diver, like penguins, it was completely flightless.

Mures can remain submerged for several minutes at a time. They have been recovered drowned in fishing nets set as deep as 180 m, and dives to 100 m appear to be common. It is amazing to think that a bird can dive to such depths, where the pressure is so great, and find its food in the darkness there.

Arctic Thick-billed Murre chicks make a remarkable swimming migration that is unique among birds. When these chicks are about three weeks old, they set out on long migrations from their breeding grounds to the wintering area off the island of Newfoundland. The first part of this journey, perhaps as much as 1 000 km, is made entirely by swimming, because the young birds are unable to fly before they are about one and a half months old. The chicks continue to grow at sea, fed by the male parents travelling with them, which are also flightless much of this time while they moult, or grow new wing feathers. No other species travels so far at such a young age, while still unable to fly. Some Thick-billed Mures found in waters off eastern Canada in winter come from as far away as Greenland, Russia, and Norway, and Common Mures found in British Columbia waters come from Alaska to the north, and Oregon and Washington to the south.

Range

The bulk of the Common Mures' Canadian breeding range is in the Gulf of St. Lawrence in Quebec and along the coasts of Newfoundland and southern Labrador. Small numbers nest on islands off the coast of Nova Scotia and in the Bay of Fundy. They also breed on coastal islands and headlands from California to Alaska, with several thousand nesting on islands off the coast of British Columbia. These birds migrate along the coast in the fall to areas where winter food is plentiful, usually within 1 000 km of their colonies. Common Mures first return to their breeding areas in March, and by late April they are establishing nest sites on rocky ledges of the colony.

Some Thick-billed Mures breed in small numbers among Common Mures on the Pacific and Atlantic coasts, but most breed in the arctic regions of Canada, Alaska, and Greenland north of the 60th parallel. They concentrate in a few huge colonies such as Digges Island in northern Hudson Bay, where about 300 000 pairs nest on sheer 200-m-high cliffs.

Thick-billed Mures that breed in west Greenland and the eastern Canadian Arctic leave the colonies in August to move south ahead of the developing

pack ice each fall, reaching the waters of Newfoundland and Labrador by November. They swim south with the prevailing currents, undergoing a wing moult that makes them flightless for up to a month. They may cover a distance of as much as 6 000 km in three months as they move from the high Arctic to Atlantic Canada. These birds are common in bays around the coast of Newfoundland in winter, except where sea ice covers the surface, and they occur on the Grand Banks as far out to sea as the edge of the continental shelf.

Thick-billed Mures along the Atlantic coast return to their nesting areas in April and May, mostly by flying, as the Labrador Current breaks up the pack ice. They are back in the colonies by June for the short arctic nesting season. Little is known about the movements of the Thick-billed Mures on the Pacific coast, which number only a couple of hundred birds. The rare individuals that winter off northern British Columbia probably come from Alaskan colonies.

Feeding

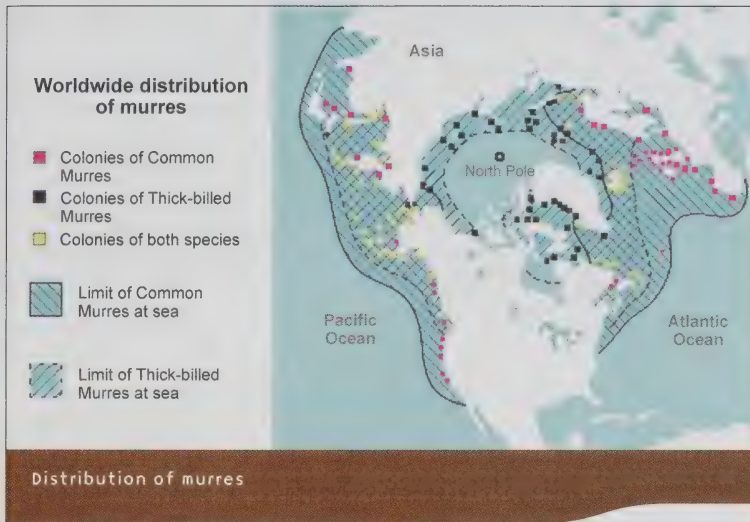
These birds spend almost all their lives at sea and dive beneath the surface to feed on fish, squid, and shrimp-like crustaceans called krill; in fact, they eat almost any marine life up to the size of a 30-g fish. Mures may approach deep-swimming schools of fish from below and attack them as they are silhouetted against the dim light far above.

Breeding

Early in the season, mures visit their colony only occasionally, but as the date of egg laying approaches, at least one member of each pair stays at the breeding site.

Most mures breed where predators such as foxes cannot reach them—on small ledges on steep coastal cliffs, on steep-sided rocky islets, and, in the case of the Common Murre, on flat rocky islets. Where the two species are found together, Common Mures generally occupy the broader shelves and tops of stacks, whereas Thick-billed Mures are confined to very narrow ledges.

Mures tend to breed in huge colonies, the largest in Canada being on Funk



Conservation

The two murre species are among the most numerous seabirds of the northern hemisphere. A little over one million Common Murres and about three million Thick-billed Murres breed in Canada, making up about 7 percent and 16 percent of the world populations, respectively. The number of Common Murres seems to have risen dramatically over the past 50 years. While the number of breeding Thick-billed Murres in Canada may have declined in the 1960s and 1970s, it seems to be stable or increasing at present. However, some colonies in west Greenland were completely wiped out by hunting in the twentieth century, and no recovery is apparent.

Human activities affect murre colonies. Some are hunted as they migrate off the coast of Greenland, and native people in Canada shoot a few thousand near the breeding colonies in a traditional food hunt each year. The biggest murre hunt occurs off Newfoundland and Labrador, where about 200 000 murres, mainly Thick-billed, are shot each winter in the traditional "turr hunt." This number, which can be sustained by the murre populations, is a reduction from a peak of over half a million birds in the early 1980s and is a result of the imposition of tighter hunting regulations, beginning in 1993. The regulations were introduced in response to changes in hunting equipment. The use of such items as semi-automatic shotguns and powerful fibreglass speedboats that could travel almost as fast as murres can fly had made the birds more vulnerable to hunters.

These seabirds can live a very long time—up to about 25 years—but many fall victim to legal hunting when quite young, often in their first winter. About half of the murres that are shot are only four to eight months old; it is impossible to distinguish young birds from older ones at a distance.

Murres are also very susceptible to contamination by oil floating on the sea, because they spend so much time on the surface of the ocean. Surveys by the Canadian Wildlife Service in southeastern Newfoundland and Labrador have found that an average of 70 percent of all murres found dead on beaches in winter

Island, 55 km off the northeast coast of the island of Newfoundland, where about 340 000 pairs of Common Murres congregate in an area of about 1.5 ha, equal to about three football fields. Imagine the noise of adults and their chicks calling and squealing, and the smells of uneaten fish and the droppings of that many birds wafting out from such a colony!

Murres of both species only begin to breed successfully at about five years of age and generally lay one egg each breeding season. No nest is constructed, and the egg is laid directly on the rocky ledge. The egg is relatively large, weighing about 100 g, and is incubated, or kept warm, continuously by one of the parents. They take equal turns of one or two days sitting while the other parent is feeding at sea. The bird keeps the egg warm by tucking it under its feathers against the bare skin of the "brood patch" on the lower belly.

An egg may be dislodged from a narrow ledge, especially if birds are disturbed and fly off in panic, or if gulls or ravens swoop in to steal the egg. When an egg is lost, a second may be laid after about two weeks. Occasionally, if two eggs are lost in quick succession, a third may be laid, but this is the most the female is able to produce in one season. A chick hatched from a late egg may not have time to grow to fledging, when it leaves the colony, before the short summer ends.

The chick hatches after about a month and is covered with an insulating coat of downy feathers. The parents continue to brood the chick to keep it warm as long as it stays at the colony. One parent always stays with the chick while the other brings it food, usually fish weighing from 5 to 20 g, which it may gather by flying to feeding areas as far as 100 km from the colony. Within three weeks, the chick grows from about 70 g at hatching to about 250 g, or a quarter of the adult weight. At the same time, it acquires a set of waterproof feathers to replace the down coat.

At three weeks, the chick tests its wings as it prepares to leave the colony with the male parent. At this age, it does not have proper flight feathers, just short, stubby wings that are not large enough to enable it to actually take off. In colonies on high cliffs, some of them more than 500 m high, the chick hurls itself from its ledge and glides steeply down to the sea, closely followed by its parent. At breeding colonies on low islands, the chick and adult scramble on foot down to the water. They set out on the chick's first foray from the breeding colony in the late evening, so that by dawn they can be as far as possible from the colony, where the chick could be eaten by gulls. They then begin their migration together. The female leaves the colony alone soon afterwards. The chick stays with the adult until it is full-grown and able to fly and feed itself, likely at about two months of age.

have oil, mainly heavy bunker fuel oil, matting their feathers. Recent estimates suggest that in some years, up to 200 000 Thick-billed and 30 000 Common Murres may die from oil pollution in the waters of Atlantic Canada.

Off Canada's Pacific coast, smaller numbers of Common Murres die each year, mainly from oil pollution and being caught accidentally in fishing nets.

Although the types of fish that are available in the northwest Atlantic have changed since the 1970s, murres are still able to find ample food in winter by switching between different food sources.

Most of the major murre colonies in Canada are now protected as federal or provincial wildlife sanctuaries, where access is limited to researchers and wildlife managers who study these birds and monitor the health of their populations. However, there are several places in Canada where people can watch murres without disturbing them. Large colonies can be seen from the dramatic cliffs at Cape St. Mary's on the Avalon Peninsula of southeastern Newfoundland and Labrador, from tour boats at Witless Bay just south of St. John's, Newfoundland and Labrador, and at Bonaventure Island on the Gaspé Peninsula in Quebec. Murres can also be seen at sea, from ferries and coastal boats around Newfoundland and Labrador, and in the sheltered waters between Vancouver Island and the mainland of British Columbia and Washington.

Canada and other Arctic countries now have murre conservation plans. If all of us—hunters, bird-watchers, fishermen, and tourists—act responsibly and recognize the effects that our actions may have, we can help these fascinating birds to remain a familiar part of our Canadian seascape.

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Catalogue number CW69-4/73-2003E

ISBN 0-662-34250-X

Text: A. J. Gaston and R. D. Elliot

Revision: R. D. Elliot, J. W. Chardine, and J. M. Hipfner, 2003

Editing: Maureen Kavanagh, 2005

Photo: Fred Bruemmer



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are species at risk, control of international trade in endangered species, and research on wildlife issues of national importance. The service cooperates with the provinces, territories, Parks Canada, and other federal agencies in wildlife research and management.

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Également disponible en français sous le titre *Le Guillemot marmette et le Guillemot de Brünnich*



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POLAR BEAR



Photo: Bev McMullen

Habitat and habits

Polar bears prefer areas of annual ice, which they use for a hunting platform and protective cover, interspersed with snow-drifted pressure ridges, refrozen cracks, and polynyas, or areas of open water surrounded by ice. This habitat preference is closely linked to the presence of their favourite food, ringed seals.

In areas such as eastern Baffin Island and Hudson Bay, where most or all of the pack ice melts by mid- to late summer, the whole bear population is forced to come ashore for two to four months in summer and early fall to wait for the ice to freeze again.

Polar bears are wonderfully adapted to their arctic surroundings. Their thick winter coats, with glossy guard hairs and dense underfur, and the thick layer of fat beneath their skin protect them against the cold. The guard hairs also shed water easily, so that after a swim the polar bear can shake itself like a dog to decrease chilling and speed the drying process. Polar bear hair is translucent and reflects the heat from the sun down to the base of the hair, where it is absorbed by the black skin.

The white colour of the polar bear also serves as camouflage. Polar bears are clever in their use of cover, be it land, water, or

Description

With its distinctive massive body and long neck, the polar bear *Ursus maritimus* is the largest land carnivore, or meat eater. The white coats of the adults often appear cream to yellow against the dazzling whiteness of their home, the arctic pack ice. Adult males measure from 240 to 260 cm in total length and usually weigh from 400 to 600 kg, although they can weigh up to 800 kg—about as much as a small car. They do not reach their maximum size until they are eight to 10 years old. Adult females are about half the size of males and reach adult size by their fifth or sixth year, when most weigh from 150 to 250 kg. Pregnant females can weigh up to 400 or 500 kg just prior to entering their maternity dens in the fall.

The bodies of polar bears are longer than the bodies of brown bears; their necks and

skulls are also longer, but their ears are smaller. Instead of having the characteristic “dished” or concave facial profile of brown bears, polar bears possess a more prominent or “Roman” nose. Their canine teeth are large, and the grinding surfaces of their cheek teeth are jagged, which is an adaptation to a carnivorous diet. Polar bear claws are brownish in colour, short, fairly straight, sharply pointed, and non-retractable.

Polar bears use a deep growl to warn off other bears, particularly when defending a food source. They also hiss and snort to show aggression, accompanied by a lowered head and ears laid back. Angry polar bears communicate their displeasure with loud roars and growls. They also emit a “chuffing” sound in response to stress. Mother bears scold their cubs with a low growl or a soft cuff.

ice. This aids both their hunting of seals and their own escape from human hunters. The bears' feet have small bumps and cavities on the soles that act like suction cups, helping to keep the bears from slipping on the ice.

Probably the most significant adaptation of polar bears to the uncertainties of food availability in the Arctic is their ability to slow down their metabolism to conserve energy at any time of year. This occurs after seven to 10 days of not being able to feed and lasts until food becomes available again. In comparison, black or brown bears can slow down their metabolism only in response to not feeding in the late fall, just before they enter their dens for the winter. If food is removed from black or brown bears in spring or summer when they are not in their winter dens, they will simply starve to death.

Although polar bears of both sexes and all ages may occupy temporary dens or shelters during periods of cold or stormy weather, only pregnant females remain in dens throughout the winter.

The bears' normal gait is a slow, lumbering walk of about 5 to 6 km per hour. They may gallop when chased, but they usually do not like to run for long. Immature bears can run as far as 2 km, but older bears tire quickly because they are fat and well insulated, which causes them to overheat fairly quickly.

Polar bears will usually not attack humans except to protect their cubs or because they are starving.

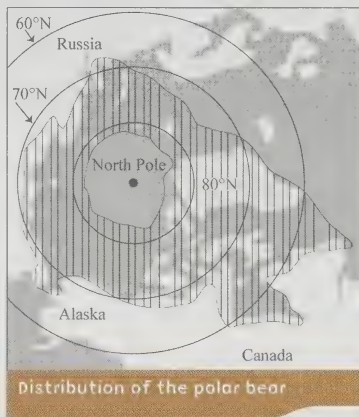
Male polar bears commonly live to about 25 years of age. Females often live into their late twenties.

When hunting, polar bears rely mainly on their keen sense of smell. They can detect seal breathing holes covered by layers of ice and snow 90 cm or more thick and up to a kilometre away. Their eyesight and hearing are probably similar to those of a human.

Polar bears are excellent swimmers. They use their large front paws as powerful oars, while their rear paws trail behind and act like rudders. Underwater, they keep their eyes open. A polar bear may remain submerged for over a minute.

Range

Polar bears are most common along the coastal areas of the Arctic and the between-island channels of the various archipelagos, or groups of islands, in the Arctic. Small numbers of bears enter the permanent pack ice that lies over the central polar basin, and some have been recorded as far north as 88°N latitude. (The North Pole, which gives the "polar" bears their name, is at 90°N latitude.) A few polar bears regularly appear as far south as Newfoundland and Labrador, and they have occasionally been noted in the Gulf of St. Lawrence in years when heavy pack ice drifts further to the south than normal.



One of the three largest maternity denning areas for polar bears worldwide is in Canada, near Churchill, Manitoba, on the western coast of Hudson Bay. The others are on Wrangel Island, in Russia, and in Kong Karls Land in Svalbard, Norway, in the Arctic Ocean.

Feeding

Polar bears are considered to be marine mammals because they depend upon seals and the marine environment for their existence. They feed mostly on ringed seals, but they also catch bearded seals, harp seals, hooded seals, and harbour seals. Occasionally, they may also kill walruses, belugas, or white whales, and narwhals.

During the winter and spring, adult ringed seals maintain breathing holes in the fast ice by constantly scratching the ice with

the heavy claws on their foreflippers. Younger seals are more abundant in areas where there is some open water during winter, such as adjacent to shore leads and polynyas, or areas of open water surrounded by ice, because it is easier to breathe there and they are able to avoid dominant adult seals that are more abundant in the fast ice.

The polar bears' large front paws are useful for hunting seals. When the seal comes up to the breathing hole for air, the polar bear kills it and flips it out of the water with a single blow of its paw.

During April and May, polar bears, especially females accompanied by dependent cubs, hunt for newborn ringed seals, or whitecoats, in their birth lairs in the underside of the snowdrifts that cover the seals' breathing holes. After smashing into the lairs and killing the seals, the bears eat mainly the fat and skin, often leaving much of the meat for scavengers. Seal pups and their mothers constitute the main part of the spring diet of polar bears, except for the nursing cubs.

Bears also stalk basking seals on land-fast ice or ice pans. During spring and early summer, when seals are most accessible, a bear may catch one every four to five days. The bear eats the fat as quickly as possible before another bear smells the kill and comes to compete for some of the carcass.

When the bears come ashore in areas where the pack ice melts during the summer, they can no longer hunt seals. They live mainly on their fat stores and conserve energy by remaining inactive over 80 percent of the time. They will scavenge on carcasses if they find them, and adolescents and females accompanied by dependent young, in particular, will occasionally eat grasses and berries. Bears have even been seen diving for seaweed and trying to catch seabirds sitting on the water by swimming underwater and coming up beneath them. Very few cases of bears killing and eating caribou and muskoxen are known.

Breeding

Males and females become sexually mature when they are four or five years old. Although the females may mate then and produce cubs, it is unlikely that many males

breed until they are eight to 10 years old. Because cubs usually stay with their mothers for two and a half years, the most often a female is normally capable of having a litter is every three years. This is a very slow breeding rate, which explains why depleted populations take so long to recover.

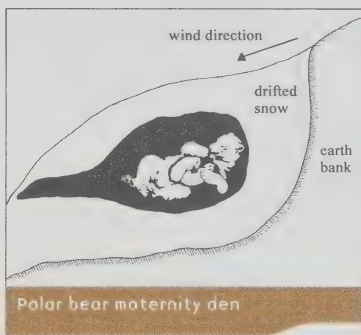
Mating occurs in April and May, when polar bears are out on the pack ice hunting seals. However, the fertilized egg does not implant in the uterus and begin to grow until mid-September to mid-October. Through most of the Arctic, maternity denning begins about mid-October. The pregnant females search for deep snowdrifts near the coast. Often they excavate their dens on the south-facing slopes of hills or valleys, where prevailing northerly winds pile up deep snowdrifts.

Dens vary in size, but the maternity denning chamber, at the upper end of an entrance tunnel 1 to 2 m long, averages a diameter of about 1.5 m and a height of 90 to 100 cm in the middle. The opening to the entrance tunnel is sealed with drifted snow shortly after the female excavates her den. The chamber is higher than the entrance tunnel, trapping any warmer air from the bears there. As a result, when the den is occupied, the inside temperature remains only a few degrees below 0°C throughout the winter, regardless of how cold the outside air temperature becomes.

The young are born after about two months of gestation, or pregnancy, from late November to early January, depending on latitude. The most common litter size is twins, followed by singletons. Triplets are born periodically, especially when feeding conditions have been good and the females are able to put on a lot of fat before denning; quadruplets have also been recorded, although this is extremely rare.

At birth, the cubs are only about 25 cm long and weigh less than one kilogram. Their eyes are closed at birth, and they are covered with hair so fine that in some early descriptions the cubs were reported to be hairless.

Most family groups in lower Hudson Bay break out of their dens from late February to mid-March, and up to one month later in the High Arctic. The family remains at the den site for one to two weeks, getting used to the cold and exercising. If the



subsequent journey to the sea ice is more than a few kilometres, the females may stop two or three times a day to rest, feed the cubs, and warm them. Once back on the sea ice and hunting continuously, the female periodically digs resting pits in the snow, sheltered from the prevailing wind, where she nurses the cubs and where they can all sleep.

The family group breaks up when the cubs are about two and a half years old. Occasionally, cubs remain with their mothers until they are three and a half years old, and in western Hudson Bay, some mothers wean, or stop nursing, their cubs only when the cubs are one and a half years old. The most difficult time in a polar bear's life is probably its first year of independence. It is still learning to hunt proficiently, and, when it does catch a seal, it is likely to have the carcass taken away by larger bears.

Conservation

Untanned polar bear pelts sell for \$500 to \$3 000 depending on their size and quality. This can make up a significant portion of an Inuk hunter's cash income. Within the annual quota assigned to each coastal village in the Northwest Territories and Nunavut, hunters are also allowed to allocate a number of hunting tags to non-resident sport hunters, who are guided on a polar bear hunt by local Inuit hunters for fees that are normally in the range of \$18 000 to \$20 000 per hunt. This is an important source of cash income for small settlements in northern Canada. The annual economic value of the guided sport hunt and the hides is about \$1 million in Canada.

The tags from unsuccessful guided sport hunts cannot be reallocated to different hunters, and one consequence of that

practice is that fewer bears are killed in total than would be the case if all the tags were allocated to subsistence hunters, or people who hunt in order to provide food for their families. Also, because most sport hunters seek large males, fewer adult females are killed overall, which provides some additional protection for the reproductive component of the population.

Polar bears are also highly valued as display animals in zoos and are one of the central attractions of the famous Moscow circus.

Bear meat may be eaten by humans and is often used as dog food. However, polar bear meat is sometimes infected with trichinosis, so it should be cooked thoroughly before being eaten. Polar bear liver can also be dangerous to humans and dogs because of its high vitamin A concentrations.

Although polar bears are not in immediate danger of extinction, they face threats common to all large predators: human encroachment on their habitat, illegal hunting, and chemical contaminants in their prey. A new threat appears to be global warming or climate change, which is affecting the polar bear's habitat by reducing the total ice cover in the Arctic, thinning the permanent pack ice of the central polar basin, and changing the timing of freeze-up and breakup in more southerly areas, such as Hudson Bay. The Committee on the Status of Endangered Wildlife in Canada has designated the polar bear as a species of special concern in Canada because of characteristics that make it particularly sensitive to human activities or natural events.

The current world polar bear population is probably 25 000 to 30 000. The Canadian population likely exceeds 15 000. The human hunter is the primary predator of the polar bear. In recent years, hunters throughout the world have killed fewer than 1 000 yearly. Between 500 and 600 of these are taken by Inuit and Amerindian hunters in Canada under a system of annual quotas that is reviewed annually in Nunavut, the Northwest Territories, Yukon, Ontario, Manitoba, Quebec, and Newfoundland and Labrador.

The Canadian Wildlife Service has been studying the ecology of polar bears since 1961. This research provides information on population size, growth rates, reproduction rates, movements, levels of toxic

chemical contamination, and the effects of long-term climatic and ecological change. The Canadian Wildlife Service is also represented on two permanent national polar bear committees (one comprising scientists and the other senior administrators), each of which meets annually to review new research results and management problems within Canada.

Conservation of polar bears requires international cooperation, as several populations are shared between countries and as problems such as contaminants and climatic change are affecting the whole Arctic. Since 1965, an international group of scientists specializing in studying polar bears has been coordinating research and management of polar bears throughout the Arctic under the auspices of the International Union for Conservation of Nature and Natural Resources (IUCN), also known as

the World Conservation Union. Five countries—Canada, Denmark, Norway, the United States, and the U.S.S.R.—signed an International Agreement on the Conservation of Polar Bears in Oslo, Norway, in 1973. The agreement came into effect in 1976. The Canadian Wildlife Service is represented on the IUCN/Species Survival Commission Polar Bear Specialists Group, which meets every three or four years and provides advice on international aspects of research and conservation to the IUCN and to the nations that signed the Polar Bear Agreement.

At present, the polar bear is one of the best managed of the large arctic mammals. If all the arctic nations continue to abide by the terms and intent of the Polar Bear Agreement, the future of this magnificent species should be secure.

Resources

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Catalogue number CW69-4/18-2003E
ISBN 0-662-34994-6
Text: I. Stirling
Sketch: Wendy Kramer

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SNOWSHOE HARE



This animal

- has a brown coat in summer and a white coat in winter
- can advance up to 3 m in one bound and travel as fast as 45 km an hour
- has up to four litters of young each year
- can reach great numbers—as many as 500 or 600 per square kilometre
- lives in every province and territory in Canada

Description

The snowshoe hare *Lepus americanus*, one of our commonest forest mammals, is found only in North America. It is shy and secretive, often undetected in summer, but its distinctive tracks and well-used trails ("runways" or "leads") become conspicuous with the first snowfall.

Well-adapted to its environment, the snowshoe hare travels on large, generously furred hind feet, which allow it to move easily over the snow. In soft snow, the four long toes of each foot are spread widely, increasing the size of these "snowshoes" still more (see illustration on page 2). A seasonal variation in fur colour is another remarkable adaptation: from grey-brown in summer, the fur becomes almost pure white in midwinter. The coat is

composed of three layers: the dense, silky slate-grey underfur; longer, buff-tipped hairs; and the long coarser guard hairs. The alteration of the coat colour, brought about by a gradual shedding and replacement of the outer guard hairs twice yearly, is triggered by seasonal changes in day length.

The snowshoe hare moults twice a year, beginning in August or September and in March or April. Generally, the hind feet retain patches of white fur into the summer. In the humid coastal zones of southwestern British Columbia, Washington, and Oregon, where snow is infrequent, snowshoe hares remain brown throughout the year.

The snowshoe hare's ears are smaller than most hares'. The ears contain many veins, which help to regulate body temperature; for example, desert hares

have very large ears with almost no fur, so the blood can cool in the slightest breeze. Because snowshoe hares live in cold environments, they do not need such big ears to help lower their body temperatures.

Female snowshoe hares are often slightly larger than males. Adult snowshoe hares typically weigh 1.2 to 1.6 kg; the hares are usually heaviest during the peak and early decline of the population cycle.

Signs and sounds

Snowshoe hares are generally silent, but they can show annoyance by snorting. On the rare occasions when they are caught, they utter a high-pitched squeal, which sometimes causes surprised hunters to drop them. During the breeding season, bucks and does (males and females) make a kind of a clicking noise to each other. Does also use this sound to call their young to them for nursing.

Habitat and habits

The snowshoe hare lives in boreal forest, the northernmost forest in the Northern Hemisphere. Its range also extends into mountains in the United States. In eastern Canada and mountainous areas, the forest is predominantly coniferous



Snowshoe hare hind foot



Jackrabbit hind foot

The hind toes of a snowshoe hare spread to form a broad "snowshoe" surface on the snow. A snowshoe hare's print is much wider than a jackrabbit's.

(spruce and fir), whereas over large expanses of Alberta, Saskatchewan, and Manitoba, the forest is mainly deciduous (aspen and balsam poplar). Snowshoe hares use many forest types. Overall, they prefer areas with a dense understory, or layer of plants below the main canopy of the forest, whether that is formed by young trees or by tall shrubs. This cover helps to protect them from predators and provide them with food.

The home range of a snowshoe hare—the area within which it normally lives—is approximately 6 to 10 ha. Within that range, the hare has an intricate network of trails that criss-cross its territory. These trails, which take the hares between feeding and resting places, are well-travelled, both by the hares and by other species, like squirrels, porcupines, and skunks. Major runways follow the same routes in summer and in winter, and the snowshoe hares keep the trails well-maintained, quickly clipping off stems and leaves which begin to block the runways; they may need these routes to escape predators.

Snowshoe hares are very active between sundown and dawn, and they remain active all winter. Rain, snow, or wind often markedly reduce the hares' activity. During the daytime, the snowshoe hare rests quietly in sheltered spots called "forms," under a bush, stump, or log. It dozes fitfully and grooms itself by licking its fur, but it is always alert.

If it is threatened, the snowshoe hare may freeze to take advantage of its camouflaging coloration, or it may flee. Snowshoe hares younger than two weeks, which cannot yet move swiftly, remain immobile. Older snowshoe hares are likely to flee; often, they will see predators before being seen, and can move away undetected. They travel by bounding, sometimes covering 3 m at a time, and they can travel as fast as 45 km/h. This is one way in which hares differ from rabbits—while hares are likely to run to escape predators, rabbits will dash to underground warrens and hide in them; hares rarely go underground. Linked to this difference in behaviour are some anatomical differences, including the hare's bigger heart, which helps it run.

Unique characteristics

The spectacular cyclic fluctuations of snowshoe hare populations are well known. These remarkably regular fluctuations, which are about 10 years long, can be traced back over 200 years in the fur records of the Hudson's Bay Company. At the population peak, hares can be extremely abundant, reaching densities of 500 to 600 hares per square kilometre. Population peaks occur roughly at about the same time, throughout the snowshoe hare's range, although the timing of peaks may vary by one to three years between regions. Population declines are largely caused by predation.

Range

The snowshoe hare is found in every province and territory in Canada. It lives in the boreal forest and the southern extensions of this forest, along the Appalachian Mountains in the east and the Rocky and Cascade mountains in the west. The snowshoe hare is found as far south as North Carolina, New Mexico, and California. To the north, it reaches the Arctic Ocean in the willow swales, or depressions, of the Mackenzie River delta.

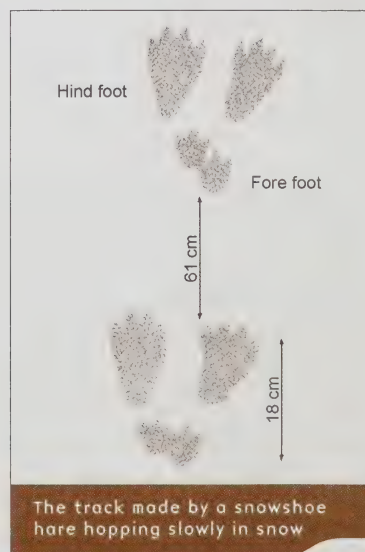
Feeding

Snowshoe hares consume a variety of herbaceous plants during the summer, including species like vetch, strawberry, fireweed, lupine, bluebell, and some grasses. They also eat many leaves from shrubs. Their winter diet consists of small twigs, buds, and bark from many coniferous and deciduous species. Their geographic range is so large that snowshoe hares in different regions may have completely different diets, depending entirely on the local forest type.

The hares often stand to clip shrubs up to 45 cm from the ground, and as the snow builds, they can clip higher and higher. In peak population years, snowshoe hares may kill saplings and shrubs by girdling, or taking rings of bark from the plants. Snowshoe hares occasionally scavenge meat from the carcasses of other animals. Most small herbivores, including mice, voles, and rabbits, will eat meat occasionally if it is available—good sources of protein are rare in plant foods, so most herbivores eat meat when they can.

Breeding

Snowshoe hares start breeding during the spring after their birth. The breeding season begins about mid-March with courtship parades. Each female is





Distribution of the snowshoe hare

receptive to males for about 24 hours, first in March, and then the day after giving birth to each litter—two to four times during the summer. During that day, females and males often travel together while foraging, with interludes of active chasing and jumping over each other. Females often breed with several males.

The first litter is usually born in May after a 36-day gestation period. Litters contain anywhere from one to 13 young. The first litter in each summer is usually the smallest, with three to four young. The second litter is often the largest, with an average size of four to seven young.

Snowshoe hares are born fully furred with their eyes open, and they are capable of hopping about almost immediately. Such precociousness is characteristic of hares in general, and is in marked contrast to young rabbits, which are born naked and blind. Young snowshoe hares

nurse only once a day, usually in the evening, and are self-supporting at three to four weeks of age. They weigh between 45 and 75 g at birth, gain 450 g within a month, and reach the average adult weight of 1.4 kg by five months.

Conservation

The snowshoe hare suffers from many diseases—viral, bacterial, and parasitic. It is also the victim of many predators: among the most common are the Canada lynx, red fox, coyote, mink, Great Horned Owl, and Northern Goshawk. Snowshoe hares younger than two weeks of age are killed primarily by red squirrels and ground squirrels. Between 1 percent and 40 percent of snowshoe hares survive each year; the rate varies with the 10-year population cycle. Although snowshoe hares can live to six years old, very few survive that long; they are extremely lucky if they make it to their second summer of breeding.

The snowshoe hare is the most important small game animal in Canada. It is a mainstay in larders of Aboriginal peoples, and on the island of Newfoundland, where it was introduced in the 1870s, thousands of snowshoe hares are snared each year for meat, and they are sold in markets. In the Prairie provinces, on the other hand, non-Aboriginals are reluctant to eat hares. This prejudice apparently stems from the widespread belief that the animals harbour a mysterious disease which causes their cyclic decline.

As one of the dominant herbivores and key prey species within the boreal forest, the snowshoe hare contributes to this ecosystem's diversity. Because they are a frequent prey item, snowshoe hares are critical to maintaining the food web in our forests; indeed, research in Yukon has demonstrated that the snowshoe hare may be a keystone, or central, species. Logging, fire, habitat conversion, and global warming are changing the distribution and quality of forested habitats. The 10-year cycle in snowshoe hares and their predators is a unique, dominant, and large-scale pattern in Canadian forests, and we do not know how habitat alteration will affect it.

Resources

Online resources

Wisconsin Department of Natural Resources, Environmental Education for Kids:

www.dnr.state.wi.us/org/caer/ce/seek/critter/mammal/hare.htm

Yukon Department of Renewable Resources Mammal Series:

www.environmentyukon.gov.yk.ca/fishwild/snhare.shtml

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Catalogue number CW69-4/44-2003E
ISBN 0-662-34256-9

Text: L.B. Keith

Revision: Karen E. Hodges, 2002

Editing: Maureen Kavanagh, 2005

Photo: Gordon Court



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